ELECTRICAL REVIEW

ILLUSTRATED.

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VIEWS, NEWS AND INTERVIEWS.

Who says Keely, the motor man, is visionary? He knows what he is about! See what he himself says:

"I am making a sympathetic harness for the polar terrestrial force by exciting the sympathetic concordant force that exists in the corpuscular interstitial domain which is concordant to it; and after the concordance is established, by negatizing the thirds, sixths and ninths of this concordance, thereby inducing high velocity with great power by intermittent negation, as associated with the dominant thirds."

If Uncle Sam may run
The telegraph, pray why
May he not go into the biz
Of making cake and pie?
Of making coats and vests?
Of fiddles and of flutes?
And those most noble garments
Three dollar shoes and boots?—*Life.*

The current number of the *Century* contains an article and a number of interesting illustrations describing and portraying "visible sound" forms. It is well worth your while to read and study the matter, as it offers exceptional opportunities for interesting research and experiment.

The latest story of an absent-minded man comes from Connecticut. A man down there owned a clump of maple trees, and when sugar time arrived he proceeded to tap them for sap in the good old-fashioned way. A telegraph pole stood in line with several maple trees and got tapped along with them. What the man expected to draw from a telegraph pole, deponent sayeth not. He probably drew his breath before saying "D-arn!"

The Newark, N. J., newspapers are scoring the employés at the power house of the Newark Passenger Railway Company for a practical joke they have been playing. Wire screens protect the windows of the power house, and some jesting dynamo tender connected up one of these screens so that a rather startling current passed through it. Small boys who like to "see the wheels go round" were in the habit of supporting themselves by the iron screens while looking through the windows. That is, they hung on to the screens till something happened. Several pairs of dirty little hands were slightly burned; hence, the newspaper paragraphs. A joke is a joke, but is it so very funny when personal injuries result? Think not.

Boston is now undeniably the center of the great electrical interests of this country. Its control of the Bell telephone, the mammoth Thomson-Houston enterprise, its large hold upon the Westinghouse Company, and within a few days its absorption of one-half of the capital stock of the Detroit Electrical Works, leaves only one company, the Edison, in which it has no large interest.—*Boston Advertiser.*

New York is certainly in hard luck. Chicago got the Columbus Fair away from her and now Boston claims to be the electrical center of the country. Still, New York will plod along as usual and continue to be the center of influence which will make the Fair a success and cause the Hub to revolve.

Mr. Lockwood Reviews the Cannon Question.

TO THE EDITOR OF ELECTRICAL REVIEW:

Concerning the cannon question of the "Constant Reader" of the New York *Sun*, which that journal reflects, and on which the views of the ELECTRICAL REVIEW are editorially given on page 136 of your last issue, it may be well enough to add a word or two, although what the REVIEW modestly calls its notion is unquestionably correct and gives a good idea of what really happens.

The constant reader of the *Sun* may be glad to know that he has heard *two* distinct reports; and that of these, the last only which he has heard was that directly due to the cannon.

The report he first heard from the telephone is an absolute reproduction, electrically brought about, of that made by the cannon; because in the electrical telephone sound is not transmitted, but is enabled to modify the electrical condition of a wire and thereby cause at a distance a reproduction or a copy of itself.

On the other hand, some seconds later, the true and original sound is heard, which has been mechanically passed along through the air from particle to particle, until the air immediately in contact with the observer's ear drum is itself vibrated.

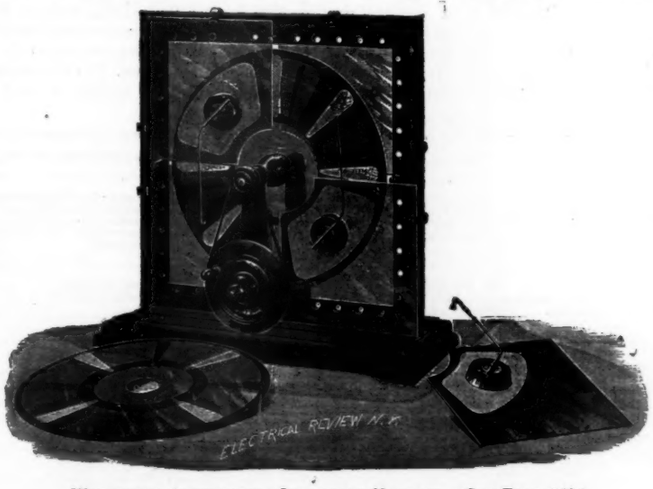
The matter can be well illustrated by reference to the autographic or copying telegraph.

In any one of these, an original picture or letter (say at Boston) may, by means of the transmitting mechanism, be caused to effect a change in the condition of the electrical circuit, which thereby acting through appropriate apparatus, is enabled to reproduce the picture (say at New York). Let it be understood that as soon as the original picture had operated the transmitting mechanism, it was sent by mail to New York. Two pictures thus reach New York; one, which is the real one, by mail; the other, which is a *fac-simile* or reproduction, by telegraph.

Very truly yours,

THOS. D. LOCKWOOD.

Boston, April 29, 1891.



WIMSHURST ALTERNATING INFLUENCE MACHINE.—(SEE PAGE 146.)

These Firms Have Moved.—Note New Addresses.

According to our annual custom, we announce below the corrections in address of some of our electrical friends who have changed their locations May 1. The moving disease has been no more wide-spread than usual this year, but our friends who have moved have bettered themselves, we know.

Himmer & Anderson, manufacturers of electrical specialties, will move from 18 Vesey street to 123 Chambers street, New York.

Mr. A. J. Van Nuis, manufacturer of the famous Ajax switches, will leave 74 Cortlandt street for the Electrical Exchange Building.

The Western Office of the Interior Conduit and Insulation Company has been removed from 1105 Owings Building to 435 The Rookery.

The Offices of "Electric Power" have been removed from 132 Nassau street to Rooms 527, 528 and 530, Electrical Exchange Building, 136 Liberty street.

The McCreary Electrical Specialty Company will move from 18 Cortlandt street to the new Electrical Exchange Building, Liberty, Washington and Cedar streets, New York.

The Complete Electric Construction Company have removed from 24 Cortlandt street to 10 Cortlandt street, New York, where they will have much larger and handsomer quarters.

The Electric Construction and Supply Company may still be found in the Telephone Building, 18 Cortlandt street, New York, but hereafter they will occupy offices 410 to 418, inclusive.

W. H. Gordon & Company, electrical supply dealers and New York agents of the Simplex Electric Company, Boston, have removed from Rooms 17 and 32, 115 Broadway, to larger, lighter and more convenient rooms, 26 and 28, in the same building.

Messrs. E. H. Johnson and J. H. McClement inform us that their offices and those of the following named companies will hereafter be in the Edison Building, 42 and 44 Broad street, New York city: Amsterdam Street Railroad Company, Twin City Construction Company, Winston-Salem Railway and Electric Company, Universal Arc Lamp Company.

Mr. Charles A. Hussey will occupy a suite of offices on the top floor of the new Electrical Exchange Building. The offices are located on the Liberty and Washington street corner of the building and command a fine view of the river and harbor. Mr. Hussey will presently put upon the market an aluminum storage battery in which not a bit of lead is used.

The Northwest Electric Engineering Company have just moved into their new store and offices at 170 Second street, Portland, Ore. The firm of Shurtz, Tobin & Cannon has recently been merged into this corporation which carries a general line of electrical supplies, handles all kinds of electrical engineering and contract work, and represents the most important of the Eastern electrical and supply companies.

"Electrical Review."—We have done a little changing about ourselves. While we still retain our old quarters, the second floor of 13 and 15 Park Row, New York, we have more conveniently arranged our offices and have remodelled and enlarged several departments. The business office will hereafter occupy Room 21, just before you as you step out of the elevator. After we get the festive painter, cabinet-maker and the millionaire plumber man disposed of, we shall be ready to receive our friends.

The Interior Conduit and Insulation Company have taken possession of their new suite of offices in the Edison Building at 42 and 44 Broad street. The offices are situated on the fifth floor fronting on Broad street and on both sides of a private hall separated from the main passageway by an artistic gate. The several rooms are large, well ventilated and have an abundance of light from all sides throughout the day. The two large rooms in front are occupied, respectively, by Mr. E. H. Johnson, president, and Mr. E. W. Little, general manager, and are furnished simply but substantially in hard wood. Mr. E. T. Greenfield, the company's electrician, has his office, draughting and show rooms directly back of Mr. Johnson's office, Mr. F. A. Mason with the financial department adjoining. All the conveniences usually found in a suite of well appointed offices go to make fitting headquarters for such a progressive company.

Press Dispatches from London to Paris by Telephone.

The Post Office authorities are stated as being very well satisfied with the success which has attended the working of the London-Paris telephone, although they anticipate a considerable development of its use in the future. The average number of messages transmitted from London to Paris daily now exceeds 50, principally stock exchange and commercial communications. One correspondent (our Mr. Ffrench, of London, writes) succeeded in transmitting 300 words for a press message within three minutes, which was received accurately in Paris.

THE PROPHET'S COLUMN.

Crooke's inaugural address, now but a few months old, gives us a conception of the ultimate particles of matter which is almost a return to the theory of the alchemists of old. Who can read his genesis of the elements without feeling that the only difference between a lump of gold and a paving stone is in the rate of motion, or according to the orbits of their ultimate particles? Such a theory furnishes a working hypothesis from which we may some day evolve a correct theory which will account dynamically for the specific gravity, chemical affinity and other properties of matter. The REVIEW recently published a description of the wonderful properties which water exhibits when in extremely rapid motion. When at rest the properties of water are well understood, but when in rapid motion it becomes in many respects like a solid, and could not be cut even with an axe. If the water in a large swimming tank were caused to assume a rotary motion, diving or swimming in it would become impossible, and a man with roller skates could easily glide along its surface.

If we are to believe Camille Flammarion, who drew such a doleful picture of the last man and woman in the *Contemporary Review* recently, the future of electricity is not particularly brilliant. He pictures a time, far in the future, when the earth is again covered with ice, and the remnant of mankind is vainly looking over the earth for a spot warm enough to live in. All of the arts and sciences seem to have been lost, although the inhabitants are possessed of flying machines. This is altogether an unscientific and unnecessarily pessimistic view, because if electrical progress goes on at the present rate, by the time that the glacial age should occur again, electricians would not only have succeeded in sailing through the air but in navigating the ether itself, and an exodus from the earth to some warmer planet would make a more interesting conclusion.

Why not navigate the ether? Every day at the Equitable Building a curious throng surrounds an electric lighting exhibit, where the attendant places a metal ring over the pole of a powerful electro-magnet through which is passing an alternating current. The ring is projected violently into the air for several inches, and if it were properly balanced it would remain there. This ring sails through the ether, and if the ether is a medium through which it is possible to convey a metallic ring for a short distance, who can say that it will not convey a larger body for a greater distance.

A pleasanter and more interesting picture would be to imagine man to have got control of all of the forces of nature, and to have so thoroughly explored the earth that no part of it remained unvisited, and that, literally sighing for more worlds to conquer, he sets off in his ether ship for a journey into space.

Speaking of electrical progress, did it ever occur to you that almost without exception the electrical industries crowd two years into one? The telephone, electric light and telegraph companies all have two sets of workers and sometimes three during the 24 hours, so that, judged by ordinary standards, the electric lighting industry in this country might be regarded as 20 years old instead of 10.

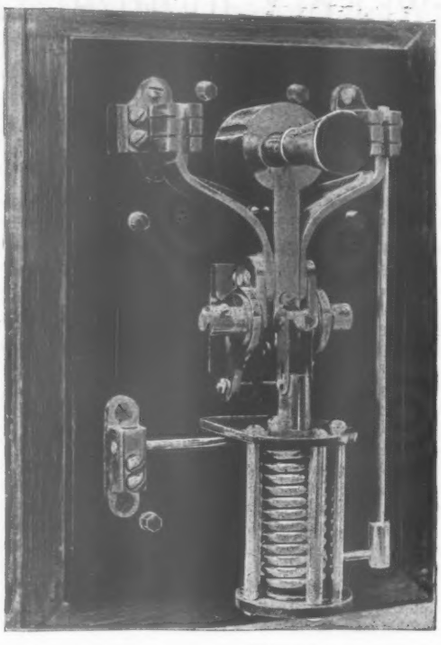
The electric light has been employed in submarine work at various times on account of the fact that the light can be completely enclosed in a glass bulb, and does not require air for its maintenance. This fact, together with the well-known actinic properties of the electric light, bring to mind the question of the possibility of submarine photography. Water does not necessarily cut off all of the actinic rays, and it is conceivable that with a properly arranged camera and electric light it would be possible to take a photograph of a sunken ship or a coral reef.

THE PROPHET.

Wimshurst's Alternating Influence Machine.

The merits of the Wimshurst influence machine are known to a very wide circle of electricians and physicists; consequently the news that the inventor has brought out another, having very curious and unlooked for qualities, will be received with interest.

A remarkable feature of the new machine (for which we are indebted to our esteemed contemporary, London *Engineering*) is, that while it gives an abundance of sparks, it is impossible to charge a Leyden jar, or similar contrivance, from it. After the electricity has been apparently flowing for minutes into the jar in rapid sparks, the latter is found to be free from all charge. Neither spark nor shock can be obtained from it, and delicate tests fail to reveal the presence of electricity in it. It is as if one had been pumping water into a bucket with no bottom; the stream is plainly to be seen, but nothing accumulates. It is, however, easy to demonstrate the integrity of the jar, and its capacity to hold a charge when filled from an ordinary machine. The conclusion is, therefore, forced upon us that the current of sparks is really the oscillation of a small charge, which flows backwards and forwards with great rapidity between the machine and the jar. The electricity that is developed is alternately positive and negative, and the normal condition of the jar is not upset.



CLEVELAND'S AUTOMATIC CIRCUIT BREAKER.

If we investigate the action of the machine more minutely by the aid of an electroscope of an exceedingly delicate construction, we find confirmation of the hypothesis that positive and negative electricity is produced alternately. Commencing to turn the disk exceedingly slowly; say, at the rate of three or four revolutions per minute, the leaves of the electroscope suddenly diverge, being repelled from each other. They remain apart quite steadily until the disk has made rather more than three-quarters of a revolution, when they suddenly approach and cling together, showing that the sign of their charge has changed. They remain thus for an instant, and during another three-quarters of a revolution, they again separate, and so on. But if the disk be turned rapidly the leaves are no longer able to respond in this way to the changes of charge. Such light appliances, with their large surfaces exposed to the air, are incapable of rapidly approaching and receding through a considerable distance under the small stresses brought to bear upon them. They consequently take up a mean position between the extreme ends of the range and show the alternate attractions and repulsions to which they are subject, by a quick fluttering or tremor. It is abundantly evident that they are subject to varying stresses, which the retarding effect of the atmosphere will not allow them to completely obey.

TABLE SHOWING RESULTS OF COMBINATIONS.

Disks.	Four Large Inductors.	Four Small Inductors.	Two Inductors and Rod.
Plain glass and no metal.	Is self-exciting with about four revolutions. Alternations occur each ¾ revolution.	Is self-exciting but requires care. Alternations occur each ¾ revolution.	Is not self-exciting but requires little assistance. Constant current while not overtaxed; gives large current.
Two metal sectors each side.	Is self-exciting. Alternations occur after each two sectors pass brush.	Is self-exciting. Alternations occur each ¾ revolution.	Is self-exciting. Constant current.
Four metal sectors each side.	Is self-exciting. Alternations occur each ¾ revolution.	Is self-exciting. Alternations occur each ¾ revolution.	Is self-exciting. Constant, but gives less current.
Eight metal sectors each side.	Is more freely self-exciting. Alternations occur each ¾ revolution.	Is self-exciting. Alternations occur each ¾ revolution.	Is self-exciting. Constant current.
Sixteen metal sectors each side.	Is freely self-exciting with three revolutions. Alternations occur each ¾ revolution.	Is more freely self-exciting. Alternations occur each ¾ revolution.	Is freely self-exciting. Constant, but gives less current.
Sixteen sectors on one side.	Is self-exciting. Alternations occur each ¾ revolution.	Is self-exciting. Alternations occur each ¾ revolution.	Is self-exciting when sectors are next the rod. Is not self-exciting when sectors are next inductors. Constant in either case.

NOTE.—The principal features are: 1. That glass disks with no metal upon them are capable of self-excitement. 2. That the self-excitement increases about proportionally to the increase in the number of sectors. 3. That the quantity of electricity decreases about proportionally to size of sectors and also their number.

The appearance of the machine is clearly shown in the engraving on page 145. A central spindle carries a glass disk 16 inches in diameter. This is varnished, and has affixed to it a number of sectors of tinfoil. The sectors measure four inches radially, while in breadth they may vary from one-quarter inch to five and a half inches. Usually the sectors on one side of the disk are arranged to break joint with those on the other side, but this is not essential. Indeed, in many respects the construction of the machine is very elastic, and many modifications are introduced. For instance, the number of tinfoil sectors many vary from 2 to 16 or more, on each side, and as we have said their relative positions on the two surfaces of the disks are not important. The results of different combinations are given in the table. The disk itself is mounted in the center of, and in the same plane as, a wooden frame 20 inches square. This frame carries four inductors of the shape shown in the detached view; they are 9¾ inches square, with one corner cut away to admit the spindle and boss of the disk. Two of the inductors are mounted on each side of the frame, at opposite diagonal corners; those at the side of machine nearest the spectator are, say, at the upper left hand and the lower right hand corners. At the opposite side the inductors are at the upper right hand and the lower left hand corners. Upon each inductor plate is a tinfoil patch of the shape shown, measuring four inches radially and seven inches circumferentially. Other inductors are provided, having upon them the smallest tinfoil patch practicable. Cemented over each patch is a wooden disk, which on its face carries a bearing in which there rides a bent brass rod, having a plume of fine wires at its end, touching the glass disks at a point 90 degrees remote from the inductor, and opposite one of the inductors at the other side of the plate. The disk is thus touched on both sides in two places. It is driven by a cord from a small hand-wheel below, and revolves in the direction of the hands of a clock. To further vary the capabilities of the machine a bar of insulating material is made to carry two metal wire p'umes at its ends, these having metallic connection with two terminals; this device takes the place of two of the inductors, and by its use a constant flow of electricity may be maintained.

The machine which we illustrate has been constructed with the view of being most readily used for the purpose of demonstration and experiment. It is provided with several disks, having different arrangements of sectors, and all the parts are made interchangeable. By withdrawing the rear bearing the nut on the spindle can be screwed off at once, when half the boss comes away and the disk can be withdrawn and be replaced by another in a few moments. The inductors lie on pegs on the square frame, and are held by light steel clips; provision is made by a number of holes in the frame for the use of inductors of different sizes.

To couple one inductor to another, if such an arrangement should be desired, holes are bored in the wooden disks carrying the brush holders, and into these holders the ends of wires can be inserted, the wires being bent in such a way to join any pair of inductors. The parts of the machine are beautifully finished, and all the ends are attained by the simplest devices.

The method of action of this instrument is not very easy to follow, and indeed no theory has yet been put forward in explanation of the results which flow from it. Probably the members of the physical society may be able to make some suggestions that will throw light on the subject.

Cleveland's Automatic Circuit Breaker for Railway Work.

The device shown in the illustration on this page is manufactured by the Forest City Electrical Works, Cleveland, O., and is the invention of Mr. W. B. Cleveland, of that company. We are indebted to the *Street Railway Journal* for the cut.

The device operates as follows: The wire from the dynamo is inserted in the lower binding post, shown on the left hand side of the cut, and the upper binding post connected with the bus wire or to the feeder. The complete circuit is therefore as follows: From the lower post around magnet to the upper right hand binding post, across the contact yoke or bar to the left hand post and thence to the line. If the line is short circuited or from any other cause the dynamos generate more than the normal amount of current, the magnet attracts the core and causes the weighted lever carrying the handle to be tilted forward beyond its center of gravity. The lever then falls forward and in its movement engages with the contact bar withdrawing it quickly from the post and breaking the current. The circuit is remade by raising the weighted lever by the handle shown, or, when a number of circuit breakers are used, one for each dynamo or feeder, they can all be set by one bar.

The Cleveland circuit breaker is mounted on a slate base 12x18 inches in size and is held in a hardwood frame. The magnet is composed of one layer of large, bare copper wire of very low resistance. The contact posts are cast of bronze and slotted and are adjustable for wear by means of screws.

The final contact is made by wedging the tapered end of the contact bar into the tapered opening of the post by means of a knuckle joint. The weighted lever in falling withdraws this knuckle, thus breaking contact easily and quickly.

There are no springs or latches to wear out, since the circuit is broken by the force of gravity acting on the weight. Thus the adjustment cannot change by time or use, and yet it is easily regulated and can be readily changed when desired. The whole instrument is highly finished and the construction throughout is of the most substantial character.

On the Potential Difference Needed to Produce a Spark.

BY F. PASCHEN.

The author has experimented with spheres of different diameters placed at various distances apart. The gases selected for testing were air, hydrogen and carbonic acid, and the influence of the pressure under which those gases were examined was also investigated. With spheres of one centimetre radius the potentials in electrostatic units (300 volts) required for sparking distances of 1, 2, 3 up to 7 millimetres, are found to be 16.1, 27.7, 38.8, 49.4, 60.0, 69.4 and 78.9, respectively, and the sparking potential is slightly less in Summer than in Winter. The potential required is less the smaller the radius of the balls, except at very short sparking distances, when a greater voltage is needed. Thus, for a sparking distance of one-tenth of a millimetre the potentials required for balls of one cm. and 0.25 cm. radius, are, respectively, 3.35 and 3.67; for a distance of three mm. the corresponding numbers are 38.8 and 38.7, and for eight mm. they are 87.8 and 66.8. The diameter of the wires leading to the sparking knobs also exercises an appreciable influence, more especially at long sparking distances. Thus, with a distance of one centimetre separating balls of one-quarter centimetre radius, the sparking potential was 68.9 for leading wires of 0.07 cm. diameter, and 73.9 for wires of 0.50 cm. diameter.

The principal result of the experiments is to evidence the following law: For a given gas at a given temperature the voltage required to produce a spark depends only on the product PD, if the pressure P of the gas and the sparking distance D are varied, that is to say, the voltage is constant if the product PD is so.

A great number of experiments were made on the three gases for pressures varying from P = 100 mm. of mercury to 750 mm.; the corresponding values of D varying from 0.75 cm. to 0.10 cm., so that the product PD was in all cases equal to 75. The mean values of the sparking potentials needed under these circumstances for air, hydrogen and carbonic acid, were found to be, respectively, 16.65, 9.68 and 17.37. The average divergence of each observation from the mean value was about two per cent. for the first two gases and three per cent. for the third.

A further set of experiments were made on the gases under various pressures with sparking distances so arranged that the product PD was 200. Under these circumstances, the mean potentials required were 34.64 for air, 19.45 for hydrogen and 33.37 for carbonic acid. The average divergences of the different observations from each other were about the same as before.

As the density of the gas is proportional to its pressure, we may state the law given above in the following form:

The difference of potential necessary to produce a spark is a function merely of the product of the density and the sparking distance; or, in other words, this difference of potential depends only on the number of molecules encountered in the path of discharge, and not on the average distance of these molecules from each other.

As M. Cardani has shown, that the sparking distance is constant in an atmosphere consisting of a quantity of air kept at constant volume, while its temperature is raised to 300° C., it may also be concluded that the sparking potential does not depend on the relative velocity of the gaseous molecules.

While the Electric Lights were Out.

[From *Vanity Fair*, London.]

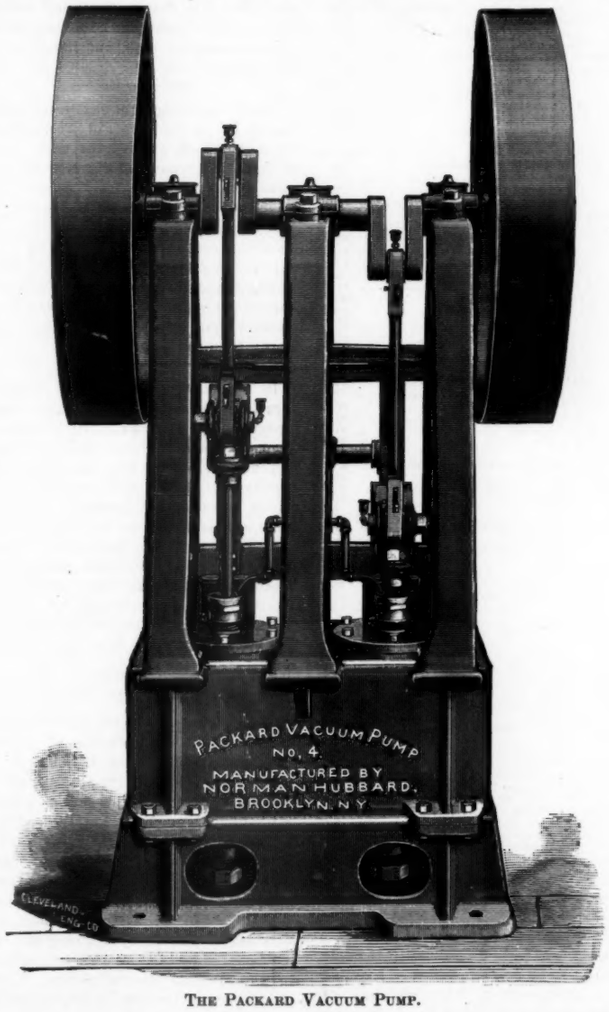
A story comes to me from Athens which is almost too good to be true, but quite too good to be withheld. The Privy Council had a meeting in the room set apart for them in the glaring, white, stuccoed palace. It was evening, and the President had just risen to address his colleagues, laying, according to custom, his gold watch on the table in front of him, so that he might mark time. Suddenly the electric light went out, but after a short interval returned. Then the President discovered that his watch, which was a present from his Royal master, was missing. He lamented, and invited his colleagues to replace the watch, but there was no response. He reminded them that the door was locked and that the watch must be in the possession of one of them. He next put each member on his word of honor to say that he had not it; which little performance was promptly got through. The President then remarked that the situation had become embarrassing; but as he wished to make things easy for the culprit, who had doubtless yielded to temptation in a moment of weakness, he would order the lights to be again extinguished in order to give him an opportunity of restitution.

This was done, and when the lights were turned on the President found that not only had he no watch but that he had also lost his silver inkstand!

The Packard Vacuum Pump.

The Packard vacuum pump, while adapted to any operation where a high grade of vacuum is required, has been designed especially for use in the manufacture of incandescent lamps, to give the highest attainable vacuum, without the use of water in the cylinders, and to be capable of heavy, continuous work. It is manufactured by Norman Hubbard, Brooklyn, N. Y., under the patents granted to Mr. J. W. Packard July 2, 1889, and April 14, 1891.

The pump has been on the market now for over four years, all details have been perfected, and it has been adopted by all the incandescent lamp manufacturers, except one, in this country. The general design and arrangement of the various sizes is clearly shown in our illustration on this page. In all sizes, the cylinders are placed vertically in a cast iron box which serves as a bed plate and water jacket, and on which the frame and working parts are mounted.



THE PACKARD VACUUM PUMP.

The frame is exceedingly rigid, insuring smooth and easy running. All parts are readily accessible, the bearing surfaces being of ample size and easily adjusted in case of wear. Each cylinder is entirely independent of the others and can be used separately or connected up as required. The suction pipes are connected at the bottom of the jacket by means of ground unions which are provided with traps to arrest any mercury or dirt, and the exhausts are piped to a pot which acts as trap to catch the oil used in lubricating the cylinders, which is then saved and may be used over again.

The valve motion is on the principle of the well-known Ritchie valve gear, greatly improved and simplified, containing no complication or liability to derangement.

All the valves are opened and closed at the proper instant, automatically, not requiring an air pressure below them to do this work. The main valve stem does not, as is usual with valves of this type, pass through the piston head. The piston packing is formed of hemp, which has been found, after numerous experiments, to give the best results; it is tight, wears well, and is easily and cheaply renewed when this becomes necessary. The clearance in the cylinders is reduced to a minimum, being generally less than $\frac{1}{16}$ of an inch, and no liquid is used other than sufficient oil to insure proper lubrication.

The valves in the piston head have their seats close to the bottom and are entirely inclosed in the body of the piston, rendering the breakage of the valve, or its giving out, an impossibility. The exhaust valves are contained in a separate bonnet bolted to the cylinder head. This bonnet has a screwed cover, by removing which the valves can be lifted out.

The materials and workmanship are first-class in every respect, all parts being made to guage and interchangeable. The cylinders and valves are of iron, which has been found, after long experience, to be much more suitable for the purpose than brass or composition. Composition cylinders and fittings will, however, be furnished when required.

Each pump is run and thoroughly tested before shipment, a mercury column being used to indicate the vacuum obtained, due notice being taken of the barometric pressure at the time of the test. A vacuum of 29½ inches is guaranteed (the barometer being at 30 inches), although a better result is generally obtained.

Mr. J. W. Packard, the inventor of this most useful and efficient piece of apparatus, was for some time the superintendent of the incandescent lamp department of the Sawyer-Man Electric Company, of this city, who, by the way, are using 23 Packard pumps. Mr. Packard, who is now the vice-president and general superintendent of the New York and Ohio Company, Warren, Ohio, manufacturers of the Packard high grade incandescent lamp, is an expert in lamp manufacture and an inventor of note.

Erie, Pa.—Keystone Electric Company; capital, $25,000.

Niles, Mich.—The Niles Electric Company; capital, $40,000.

Covington, Ky. — Ludlow Fire Alarm Company; capital, $150,000.

Shawano, Wis.—The Train Order Annunciator Company; capital, $100.

Chester, Pa.—Arnold Electric Manufacturing Company; capital, $50,000.

Chicago, Ill.—The Chicago Electric Protective Company; capital, $100,000.

Buffalo, N. Y.—Instantaneous Fire Alarm Telegraph Company; capital, $50,000.

Marshfield, Ore.—Marshfield Edison Light and Power Company; capital, $30,000.

Atlanta, Ga.—The Carlton-Johnson Railway Signal Company; capital, $100,000.

Edgewood, Pa.—Edgewood Electric Light, Heat and Power Company; capital, $1,000.

New York, N. Y. — Seibold Electrode Manufacturing Company; capital, $100,000.

Pecatonica, Ill.—The Pecatonica Electric Light and Power Company; capital, $10,000.

Toledo, O.—Egbert C. Misner, Michael McGrath, Robert A. Brinkerhoff, W. F. Cooney and Louis E. Richardson, are the incorporators of the Chamber's Electric Appliance Company; capital, $25,000.

Barraboo, Wis.—The Barraboo, Devil's Lake & Kilbourn City Electric Railway Company; capital, $35,000. Incorporators, F. T. Brewster, J. P. Witwen, E. N. Marsh, T. Clavadatscher, H. J. Irwin and G. A. Kartack.

Quincy, Mass.—The Quincy Electric Freight Railway Company; capital, $300,000. Incorporators: John Q. Adams, Henry L. Higginton, Charles H. Porter, W. G. A. Pattee, P. L. Saltonstall, G. E. Armstrong and J. R. Graham.

Chicago, Ill.—Harvey Electric, Water and Gas Company, to build and maintain water and electric or gas works, Harvey, Cook County; capital stock, $100,000. Incorporators, Horace H. Badger, Charles D. Starwood and Willets G. Wanzer.

Sacramento, Cal.—The Central Railway Company was reorganized under the name of the Central Electric Railway Company, with a capital stock of $500,000, and the following as directors: J. H. Henry, W. E. Henry, John P. Burke, L. L. Lewis and J. G. Martine.

Baltimore, Md.—The Electro-Automatic Transit Company, of Baltimore City, has sold its right, title and interest to the Weems Electric Railway System, a new company organized in New York to develop electric rapid transit. The Weems Electric Railway System has been organized with a capital of $2,500,000, divided into shares of $100 each. The officers are: O. J. Smith, president; David C. Weems, vice-president and general manager; Wayne B. Stowe, secretary; John N. Grant, treasurer; A. DeR. Cappington, counsel. The general offices of the company will be in New York. The engineering department still continues in Baltimore, with David C. Weems in charge.

What Mr. Richards Saw in the Dark.

TO THE EDITOR OF ELECTRICAL REVIEW.

A short time ago, I saw a curious thing which may be of interest to your readers.

I happened to be in a dark room and the elastic on my sleeve having slipped down, I pulled it up and snapped it down on my arm. As I did so, a flash of fire was apparent between the elastic and the sleeve, as large as a good sized marble. I repeated it several times that evening, but have not been able to get so large a spark since.

Boston, May 1, 1891. W. S. RICHARDS.

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The decision of the Rapid Transit Commission is looked forward to with the utmost interest by all concerned in the development of electric traction. There will be a widespread disappointment if an electric underground road does not at least form a part of the scheme decided upon.

Electric launches have long been popular in England and they are becoming more so every day. The success of the flotilla which was kept in operation during the Edinburgh Exhibition was highly satisfactory and the launches are to be used in Scotland this Summer. On the upper reaches of the Thames electric launches are familiar objects among the numerous other craft. We prophesy speedy and profitable returns to the individual who is enterprising enough to equip a charging station on the banks of the Hudson and inaugurate an electric launch service on that noble river. During the Summer months there would be many who would be glad to make a trip on the river in an electric boat. The expenses of maintenance are not great, and if properly managed we feel sure that the scheme would soon be a distinct success.

May all the electrical movers be happier in their new quarters, is the wish of the REVIEW.

Notwithstanding the cry of hard times, the electrical industry is active and progressive. If you doubt this, just note a few of the artistic and striking and interesting cards appearing in the REVIEW'S advertising pages. There may be a few electrical concerns that do not think they get their share of paying business, but they do not advertise in the REVIEW.

The Electric Club, of New York, is one of the most creditable institutions of the city, and every one directly or indirectly connected with electrical work should give it aid and encouragement. The newly-elected officers are taking hold of the affairs of the Club with a zest and intelligence that promises excellent and progressive results. Much good work has been done in the past, more should be done in the future and the Club made the great center of electrical influence—scientific, social and industrial—of this continent.

There is a sad sight for electrical men in a vacant lot at the corner of Thirty-fourth street and Park avenue just now. There the handsome accumulator cars which up to quite recently were so freely patronized by travelers on the Fourth and Madison avenue line are huddled together in attitudes of despondent confusion and inactivity. The cars were a valuable object lesson to the inhabitants and visitors of a great city in the capabilities of electric traction, and it is a thousand pities that they have been withdrawn from active service.

In the Cincinnati *Commercial-Gazette* for April 26 is described an elevated electric system designed by Mr. L. H. Goodwin, of Avondale, in which it is proposed to support the cars pendulously from rails mounted in a rectangular arch supported on posts. The motor is secured to a framework above the rails and is geared to the hanger wheels. There is no important feature of novelty in this system which is described at length with a series of illustrations. The arches in which the rails are hung would preclude the possibility of curves, as the lateral sway of the car body would swing it in line with the side of the arch.

LIGHTNING'S PECULIAR ACT.

A communication to the April number of the Journal of the Institution of Electrical Engineers (London) from the electrician of the Indian Telegraph Department, gives an interesting account of the curious effects of a lightning flash on a tree near the telegraph station at Thayetmayo, in Lower Burma. During a violent thunderstorm, one flash of lightning was noticed to be exceptionally vivid, and appeared to last for several seconds. On the following day it was found that a tree had been struck by lightning and it was conjectured that the damage had been done by the particular flash alluded to. The tree had two main branches diverging from the top of the trunk. About six feet from the base of the trunk an iron tank, measuring 5x2x2½ feet, had been buried.

The trunk was split in two, from the fork where the main branches diverged, clean down to the ground, and the bark on one side completely torn away, in evenly divided shreds, which were resting on the ground. The damage was entirely confined to the side of the tree nearest the tank. Within a few days the branches had withered and decay had commenced over half the trunk, while the remaining portion of the tree retained its usual healthy appearance. Curiously enough, this was the only tree that was struck, although it was surrounded by others of greater height and standing on higher ground; and it is a question, therefore, whether the iron tank alluded to was the primary cause of the disruptive discharge taking place where it did. In all respects this is one of the most remarkable examples of the vagaries of lightning that we have seen recorded in many years.

THE VOICE WILL GIRDLE THE EARTH.

Gratified with the success of the London-Paris telephone, the London electrical papers are talking of a telephone between the United States and Great Britain. It is believed that the mechanical difficulties may be overcome.—*Boston Globe.*

There is no trouble in store by reason of mechanical difficulties. These were overcome long ago when the first ocean cable was laid, and the story is a chapter of ancient history. The difficulties are purely *electrical.* It is found that both static and self-induction are the disturbing factors, and, when a wire exceeds a few hundred miles in length, mutilates speech by destroying the character of the electrical undulations so that they no longer come out at the distant end of the wire with the sinusoidal curve of the electromotive force impressed at the transmitting end. With copper, the best commercial conductor known, it has been found impossible to obviate this evil. In the case of a submerged conductor the evil is greatly exaggerated by a condenser-like action of the cable. The great rapidity of sound necessary to transmit speech demands a shorter conductor than will reach from England to the United States with the present modes of telephonic transmission. Inventive ingenuity and scientific research combined make a solution of the problem a hopeful possibility. Perhaps the waves can be relayed; perhaps the trouble would be mitigated by using a line current of greatly increased E.M.F. The whole subject is only partially understood. Reading the future by the triumphs of the past, we are not over sanguine in believing that the difficulties will be overcome, and that the whole world may be brought within sound of the human voice.

THE OCEAN AS A BATTERY.

A writer in the *Evening World* says:

I met a young enthusiast in the matter of electrical research and a constant experimenter, who told me that in a short time he meant to have an electric yacht which would be a marvel, 60 feet in length. The sea was to supply the place of a battery in some way, so that the craft would derive her motive power from the element she moved in, and there would be virtually no loss of space and no crew necessary. It sounded like Munchausen, but the young man assured me he had a small launch running successfully on this new plan. I would like a trip in that yacht.

The ambitious tyro is wasting energy which might find a more useful field of effort. This is a chestnut raked from the dried leaves of 25 years ago. It was proposed then to cover the hull of a ship with zinc and copper, and thus make of it a pair of electrodes which would be acted upon by the salt water in which they floated. It is a dream almost as Utopian as the political theories of Bellamy, and is worthless because there are infinitely better ways of accomplishing the result, and as the energy developed by zinc costs about 30 times as much as that given by coal, to say nothing of the costs of repair, one reason is very plain why the scheme has never been practically applied.

CHEMICAL AFFINITY OF IRON CHANGED BY MAGNETISM.

In a paper recently read before the Royal Society, Mr. Thomas Andrews gave the results of some experiments carried out by him on the effect of magnetization on the relative electro-chemical properties of a pair of bright iron bars, one magnetized by a coil, the other unmagnetized, when simultaneously exposed to the action of various powerful oxidizing agents and saline solutions. The bars were placed in the legs of a U tube containing the electrolyte, every care being taken to check any E. M. F. which might occur owing to the rise of temperature in one leg caused by the current in the magnetizing coil. The solutions employed were potassium chlorate + one-fifth and one-third nitric acid, potassium chlorate and hydrochloric acid, 25 per cent. and 30 per cent. aqueous solution of nitric acid, a 50 per cent. aqueous solution of hydrochloric acid, concentrated sulphuric acid. The magneto-chemical effects were very small, being usually about one thousandth of a volt.

CORRESPONDENCE.

OUR BOSTON LETTER.

Mr. James Goldmark, of Messrs. Wallace & Sons, New York, was in the city a few days this week looking after the interests of his firm.

The Germania Electric Company, successor to the Schaefer Electric Manufacturing Company, will soon be comfortably settled in its new factory at Mariboro, Mass.

Mr. James R. Magee, manager of the Thomson-Houston Electric Company's isolated lighting department, who has been sick for two weeks, is now recuperated in health.

The Erie Telephone Company's sub-companies made a net gain of 229 subscribers for the quarter ending March 31, or a total gain of 1,131 for the fiscal year ending the same date. This company has declared a quarterly dividend of one per cent. to stockholders of record May 6, payable May 18; books close May 1 and open May 10, 1891.

The Thomson-Houston Electric Company's isolated lighting department has closed a contract with the United States government for the early installation of an isolated plant consisting of 40 arcs and 50 incandescents in the government's immigration depot on Ellis Island, New York Harbor. The contract specifies that this plant shall be ready to start up by the third week in next June.

The Hartford Engine Machine Company, of Hartford, Conn., whose building was burned recently has begun moving all the machinery to its new location in the building formerly occupied by the Schuyler Electric Light Company, where there will be put in one of its new vertical engines for running the works. This company had been in business but a short time when the fire occured.

The Eastern Electrical Supply and Construction Company has just completed the enlargement of its salesrooms, No. 65 Oliver street, this city. This enables this active and enterprising company to present to the trade varied and complete lines of electric light and electric railway supplies. This concern has placed on the market its electric pull bell, a novelty which is certain to meet with public favor.

The Telephone Employes' Ball, given at Odd Fellows' Hall, April 15, and mentioned in the REVIEW at the time, realized a surplus fund of nearly $90. This sum was donated to one of the employés who is an invalid. It has been decided by the telephone employés to organize among themselves exclusively a benefit organization, and subscriptions will be asked to create a fund to aid and care for any sick member.

New England Telegraph and Telephone Company has been prevented getting into its new offices and operating rooms by unexpected delay on the part of the contractors and builders in finishing the interior of the American Bell Company's magnificent edifice corner Milk and Oliver street. An item published in the Boston *Beacon* of this date reports that the above named company is selling $500,000 six per cent. 15 year bonds at 102⅔, which makes a total funded indebtedness of $1,500,000. The money realized from this sale will go largely into underground work.

Removal.—The New England district of the Edison General Electric Company has removed its offices from No. 38 Pearl street to No. 25 Otis street and 104 Arch street, and will occupy the entire first floor and basement.

The first floor is divided up into offices, fixture show rooms, and retail department, and the basement is to be used as a stock and packing room.

The main entrance on Otis street opens into the principal fixture show room, which is stocked with a large variety of the latest designs in electric, gas and combination fixtures, brackets and stand lamps.

At the right hand of entrance is the draughting room, and to the left is the engineer's office. Adjoining the former room is an office occupied by the railway, lighting and power departments. Next beyond is a special fixture show room, finished in white and gold in the Adams style of parlor decoration, where is shown an elaborate and varied line of fixtures. The apartment next adjoining is also used as a special fixture show room and is finished in Colonial style with fixtures, fittings, etc., appropriate to that time, with modern electric improvements added.

In the special fixture rooms may be seen artistic and attractive electric, gas and combination fixtures in silver, bronze and iron; some in antique style and others more modern in design.

Near the Arch street side of the first floor is the counting-room, fitted up in black-walnut and mahogany.

Near the Arch street exit is an electric elevator, used for passengers and freight, made by the Whittier Machine Company and operated by a Sprague electric motor.

The officers are: Sydney B. Paine, district manager; William H. Francis, district auditor; and Arthur R. Bush, district engineer. The names will be recognized as formerly identified with the New England Wiring and Construction Company, and of the firm of Paine & Francis.

The fixture department and show rooms are under the care of Mr. Henry T. Edwards, formerly with Mitchell, Vance & Company and Bergmann & Company.

Mr. A. T. Starkey, formerly of the Sprague Electric Railway and Motor Company, has charge of the railway department; and in the motor department may be found Messrs. George F. Steele, William Austin and A. B. Halvorson.

Messrs. Stephen A. Douglass and Chas. C. Peirce look after the interests of the lighting department. W. I. B.

Boston, May 2.

OUR ALBANY LETTER.

Two Hundred and Fifty electric lamps are to be put in the Watervliet gun factory.

Mr. Stein's Assembly Bill, creating a board of telegraph commissioners, has been ordered to a third reading.

Mr. Woodbury's Bill, allowing the Dunkirk and Fredonia Railway to use certain streets in Dunkirk, has passed the Assembly.

Mr. Brodsky's Bill, extending for one year the term of office of the New York Board of Electrical Control, passed the Senate Wednesday.

Senator Vedder's Bill, allowing villages to contract with individuals as well as corporations for electric lighting, passed the Senate Thursday.

Mr. Gifford's Bill, allowing villages to contract with persons as well as corporations for electric lighting, has been reported favorably by the Assembly village committee.

A Bill has been passed in the Assembly, introduced by Mr. Rice, allowing the superintendent of public works to experiment with electricity as a motive power on the Erie canal.

Mr. Connelly has introduced a bill in the Assembly authorizing the commissioners of the New York fire department to have the electrical conductors of the fire telegraph laid underground.

The Telephone Service in this city is just beginning to recover from the fire in the telephone exchange which occurred recently. Business has been delayed for weeks by the frequent storm destructions, and the recovery of the service is much appreciated by business men. L. M. W.

Albany, May 2.

OUR CHICAGO LETTER.

The Standard Oil Filter Company, manufacturers of the Ellis oil filter, report a decided increase in sales for the last month.

Mr. George T. Manson, of the Okonite Company and inventor of the celebrated Manson insulating tape, spent a few days in Chicago this week.

Mr. J. C. Hobart, secretary of the Triumph Compound Engine Company, was a recent visitor in this city. An excellent business is reported from all quarters.

The Mayor and Council of Crawfordsville, Ind., have been in Chicago this week purchasing supplies and machinery for their new municipal electric plant.

Mr. Edward R. Grier, superintendent of the Southern Electric Light, Heat and Power Company, has gone into the testing department of the Thomson-Houston Company at Boston.

It is About Definitely Decided that a suitable space in the Electrical Building of the World's Fair will be set apart for the exhibition of the models, etc., of amateur electricians.

Mr. W. L. Adams, electrical engineer of the Northern Engineering Company, of Buffalo, N. Y., has been in the city for several days. This firm are building the new electric street railway at Marion, Ind.

Mr. P. C. Ackerman, of the American Electrical Works, has just returned from a lengthy western trip, passing through Chicago a few days ago. Mr. Ackerman says there is an apparent electric railroad boom throughout the entire West.

Mr. H. P. Lucas, general manager of the Chicago Insulated Wire Company, is very much pleased with the way business starts out. The factory has been open but a few weeks and it has become necessary to increase the force to nearly three times the original.

The Chicago Incandescent Light Company have about completed their improvements and increase of plant and will, in a week or two, be turning out about 500 lamps per day. They are guaranteeing a first-class lamp in every particular and at a price advantageous for all.

Bleckert & Nelson, fixture manufacturers, will shortly remove to more desirable quarters, their business having outgrown their present quarters. New machinery has been purchased. An increase in working force will at once be put on, enabling them to turn out work more rapidly. They will shortly issue a handsome catalogue of their goods.

Mr. M. Pfatischer, who has charge of the electrical equipment of all street cars operated under the Accumulator Company's storage battery system, passed through this city this week *en route* to Dubuque, Ia., to superintend the starting of the Edco cars recently sold to the Dubuque Street Railway Company. Mr. P. expects to have everything ready for a start in about three weeks.

The Des Moines Electric Light and Power Company were deprived of their water-power on account of the recent ice gorge, but Mr. C. K. Meade, the enterprising superintendent of the plant, found an immediate way out of the difficulty. He made a tour of the city, found some portable threshing machine engines, backed them up to the side of the power house and started off, not a minute being lost in light or power to consumers.

Force Bain will shortly place upon the market an entirely new type of motor, very simple in construction, compact, with few parts, and which Mr. Bain claims will be highly economical. The armature shaft revolving in self-oiling beorings of Mr. Bain's invention. He has also perfected an entirely fireproof switch for incandescent dynamos and motors. The face of the switch forms the box and the resistance coils are put in in detachable iron trays, each tray representing an increase or decrease of about one horse-power. It is automatic in every particular, thus making it impossible to leave the arm on any intermediate contacts. L. W. C.

Chicago, May 2.

OUR CINCINNATI LETTER.

Work is Progressing very rapidly on the Cincinnati Street Railway Company's new extension to Pendleton, and the cars will soon be running.

The Palace Hotel of this city have almost completed the installation of a 600 light Queen City dynamo, and expect to be running in a short time.

The Electric Supply and Contracting Company have just secured the contract for installing an electric plant on one of the largest boats running on the Ohio River.

The Central Thomson-Houston Company have the contract for wiring the new building at the southwest corner of Vine and Fifth street, owned by Mabley and Carew.

The Western Electric Company have just installed a plant of 40 arc and 100 incandescent lights in the Frey Printing Company's new building. This is one of the largest establishments of its kind in the United States.

The Western Electric Company, of Chicago, have secured the contract for wiring the New City Hall, amounting to $10,519.28. The work will be commenced very soon, Mr. Edward Elliott, expert from the company, will have this work in charge.

The Past Week has been one of trial and tribulation to the patrons of the East End Ball Park, as they could not be accommodated by the street railway. The electric road will be welcomed with a shout when completed, as it will then be able to be of good service to all passengers.

Post & Company, of this city, have added a new department to their well established house. They will manufacture all kinds of telephone, telegraph and electric light and railway supplies. Mr. O. M. Hubbard formerly with the Central Thomson-Houston Company, of this city, will have charge of this department.

Articles of Incorporation were filed yesterday with the Secretary of State for a company, with abundant capital, now ready to enter upon the construction of electrical subways of sufficient capacity to accommodate the wires of the companies now in operation. This is a move in the right direction, one common conduit. E. S. M.

Cincinnati, May 2, 1891.

OUR DETROIT LETTER.

Mr. Warfield, general manager of the Detroit Electrical Works, is absent from the city on a 10 days' business trip.

The Michigan Electric Company have been appointed agents for the Card Electric Company, of Cincinnati. They are also introducing the Healy system of ventilating fans.

Mr. R. S. Russell has perfected and will shortly place upon the market a very novel electric cigar lighter.

Arrangements are about completed for the building of large additions to the factories of the Detroit Electrical Works. This company has in one year entirely outgrown its new factory. Some recent sales of the company are to I. N. Beckley, Lawrence, Mass., fifteen 30 horse-power Standard Rae motors and trucks, five 30 horse-power, Bristol, Tenn., and five 30 horse-power, Athens, Georgia.

The Fisher Electric Works, Leonard street, Detroit, have just completed the entire electric light and power equipments (marine) for some of the largest marine transportation companies operating on the chain of lakes. The new Fisher dynamo and switchboard, especially adapted to this class of work, having superseded in some cases some of the oldest systems. This company are making a special portable Hotchy cluster that should be seen by every vessel owner operating or contemplating the operating of electric lights on their crafts. L. W. C.

Detroit, May 1.

Carbon Vapor in the Electric Arc.

TO THE EDITOR OF ELECTRICAL REVIEW:

With great interest I read Prof. E. Thomson's letter in the last issue of the ELECTRICAL REVIEW. I am glad to notice his explanation of the bands in the spectrum of the arc stream, as the characteristic carbon spectrum.

I noticed those bands several times, too, but, seeing them appear only occasionally, and not always, I attributed them to the presence of hydrocarbures in the arc stream, the more so, as even the best carbonized organic matter always contains a certain amount of hydrogen and oxygen and the spectrum of hydrocarbures is characterized by its bands, so that I had a certain reason to explain the occasional appearance of bands in the arc spectrum by the presence of hydrocarbures. But with the same right on the other hand, Prof. Thomson can consider those bands as the characteristic carbon spectrum, which appears only under favorable conditions and otherwise is covered by the continuous spectrum of *condensed* carbon vapor. The appearance of the same or similar bands in the spectrum of hydrocarbures would find their explanation then, perhaps, by the direction of the carbohydrure through the electric spark.

That under the entirely different conditions of the electric arc a somewhat different spectrum is to be expected, can be foreseen the easier, as it is known that even ordinary gas spectra, like that of nitrogen, become more homogeneous when the temperature is raised considerably.

That the temperature of the electric arc is near the melting and boiling point of carbon was shown already by some French scientists, who, about 20 years ago, I believe, were able by means of a battery of 600 Bunsen cells to evaporate carbon and to bring it into plastic condition.

To those temperature determinations of the electric arc, which I incidentally mentioned in my previous letter, I attributed only very little value, first, because of their early date, and then, because even the method of the determinations is open to some objections. Exact temperature determinations, I agree with Professor Thomson, meet with great difficulties, and have not been carried out yet. Yours truly,

CHAS. STEINMETZ.

Yonkers, N. Y., May 1, 1891.

Disappearance of W. J. Armstrong.

Mr. W. J. Armstrong, for the past two years connected with the Bishop Gutta-Percha Works, 426 East Twenty-fifth street, New York, drew $551 out of the American Exchange Bank Saturday, and has not been seen by his employers since. The money was for the company's pay roll, and for the first time in a score or more of years the company was compelled to miss a pay day.

Mr. Armstrong has been identified with electrical work here and in Chicago for many years, and his friends are hopeful that he will yet show up and satisfactorily explain his absence.

FINANCIAL.

Closing quotations of electric stocks, from F. Z. Maguire & Co., Electrical Securities, 18 Wall street, N. Y., Saturday, May 2, 1891. New York, Boston and Washington Stock Exchanges.

NEW YORK.	
Western Union Telegraph Co.	82¾
American Telegraph & Cable	
Central and South American	145
Mexican	205
Commercial Cable Co.	105
Postal Telegraph Cable	39
Edison General Electric Co.	100
Consolidated Electric Light	
Edison Electric Illuminating Co.	16
United States Electric Light	30
North American Phonograph	
BOSTON.	
Thomson-Houston Electric Co.	47¼
" " " Preferred	25¾
" " " Series C	9
" " " Series D	7¼
" " International Co.	
" Welding Co.	
" European Welding Co.	55
Ft. Wayne Electric Co	13¾
Detroit Electrical Works	
Westinghouse Electric Mfg. Co.	15⅝
TELEPHONE:	
American Bell	206
Erie	50
New England	52
Mexican	1.00
Tropical American	
MISCELLANEOUS:	
Edison Phonograph Doll	
WASHINGTON.	
Pennsylvania Telephone	26
Chesapeake and Potomac	8
American Graphophone	5⅛
United States Electric Light (Washington)	167
Eckington and Soldiers' Home Electric Railway	54
Georgetown and Tennallytown	63

Telephonic News

⁂ The telephone cable has been completed through the St. Clair tunnel.

⁂ The Sunset Telephone Company has equipped the fire department of Seattle, Wash., with a telephone system of its own.

⁂ The Sunset Telephone Company has secured enough subscribers to warrant introducing their system into Centralia, Wash. Seattle and other cities will then have connection with Centralia.

⁂ The Southern New England Telephone Company has mortgaged to the Union Trust Company, of Hartford, Conn., property valued at $300,000. The telephone company will use the money in extending its lines and making improvements.

⁂ The Erie Telephone Company's subcompanies made a net gain of 229 subscribers for the quarter ending March 31, or a total gain of 1,131 for the fiscal year ending the same date. Last year the net gain was 930. Total number connected, 13,376.

⁂ Manager Uline, of the Hudson River Telephone Company, has announced that the service would be once more in working order this week. The operators have been notified to report for duty. Every precaution has been taken to protect the office from being "struck by lightning" again. Subscribers will not be charged for the use of their telephones since April 3.

⁂ The National Telephone Company, which enjoys a monopoly of the service in London, is threatened with a rival, unless it reduces its rates and improves its service. A committee for the protection of subscribers has been formed. The postmaster-general is quoted saying that he could not be indifferent to a clearly expressed demand for the establishment of a telephone service in London.

⁂ The directors of the Hudson River Telephone company met last week in Manager Uline's office to examine plans for the new building. The following were present: Joseph P. Davis, C. J. French, James Bigler, H. L. Storke, of New York and Boston; James H. Manning, A. B. Uline, of Albany. President Davis presided, and Mr. Uline was secretary. Mr. James H. Manning and D. Cady Herrick were elected directors. Mr. Frank Wright exhibited drawings and plans for new building which were accepted, and it was decided to begin tearing down the buildings that are on the site selected, this week.

Paris-London Telephone Line.

The Paris telephone line was the subject of an interesting experiment. Five receivers were connected in the Post Office, and the other end was put to the Grand Opera at Paris. The orchestra could be heard so clearly that the separate instruments could be heard joining in. In a duet the two voices could be distinguished, and the applause of the audience and cries of "Bis" were also clearly heard. The transmitters were microphones, placed on the stage of the Opera House. On Tuesday the line was thrown open gratuitously, and numbers of business men availed themselves of the opportunity to test the line. On Wednesday the line was opened to the public at the charge of eight shillings for three minutes' conversation. A sound-proof box has been constructed of sheet lead and doe-hair to prevent any possibility of any one overhearing private confidences of the Stock Exchange. A double pane of glass is fitted in the door, and an automatic electric lamp lights up on taking the seat. The influence of the sea in diminishing the volume of sound is very marked, as is seen in trying first to Dover and then to Calais. All day long messages were exchanged, but an unforeseen difficulty, alluded to in our leader, will obviously prevent a good many people from making as much use of it as they, perhaps, would have wished.—*London Electrical Engineer.*

The Commercial Production and Application of Ozone.

BY ERNST FAHRIG.—ABSTRACT.

Oxygen, besides being the most widely-distributed element in nature, occupies a unique position among gases in that it also exists in an allotropic form, possessing properties peculiar to itself, which strongly distinguish it from the parent body. In a manner which our knowledge of molecular physics is not yet sufficiently advanced wholly to indicate or explain, the oxygen can become subject to great internal tension; so that it undergoes a condensation to two-thirds of its normal bulk, and, from a substance usually inert and stable, is transformed into a powerful gas—a strong and energetic oxidant—which readily yields up a portion of its substance to assume again, without loss of volume, the condition of ordinary oxygen. To so produce it commercially has been a problem of the age. But the many eminent scientists who have experimented with it achieved little or nothing of success. Though discovered in 1845, it is still in the embryo state.

At our works we have met with the most gratifying results, quite justifying our claim that the labor of years has at last been crowned with complete success. The enormous advance of late years in electrical and dynamical science has brought more powerful forces and agencies to our aid.

Let us review a few of the processes by which ozone has been prepared; and observe why these have no commercial value. First, there is the time-honored process of passing moist air over amorphous phosphorous; the ozone produced is of very indifferent quality and very impure. Secondly, oxygen is given off in the form of ozone when peroxide of hydrogen and potassic permanganate is acted upon by strong sulphuric acid; but this method is too expensive for commercial purposes, and in other respects is not satisfactory. Thirdly, when water is decomposed by an electric current, oxygen is separated partly in the form of ozone; here there is only a partial formation in indefinite quantities, which uncertainty is quite sufficient to deter practical men from adopting such means. Fourth, there is a partial conversion of oxygen into ozone when it passed between terminals across which is projected by means of a Rhumkorff coil, the brush of a powerful electrical discharge. The same objections apply to this method as to the one immediately preceding; though we may say that it is the most promising of the whole, the one most susceptible of improvement, and, to a certain extent, it is the principle upon which we have worked and succeeded.

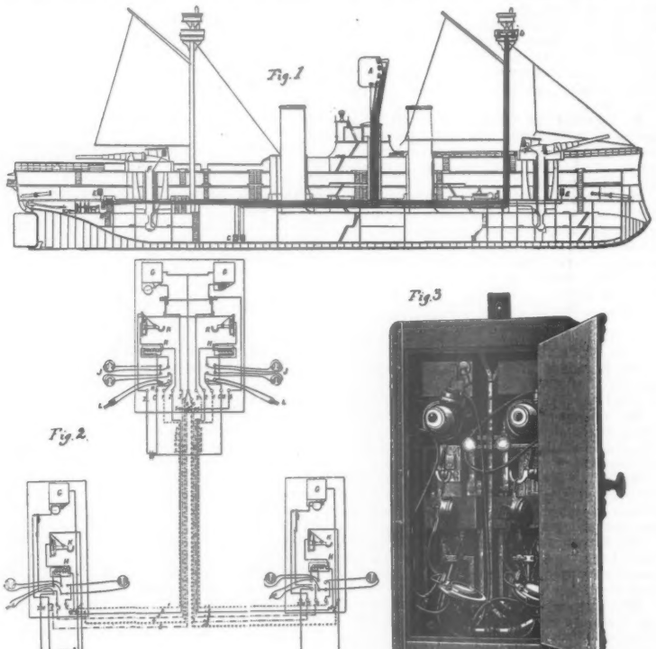
Of our process we cannot in justice to ourselves give full details here. We produce the ozone directly from atmospheric air. Our process is essentially a mechanical one, depending upon none of the tedious nicetles of chemical science, but only proceeding in the bold, plainly defined way of the electrical engineer.

Our apparatus exhibits a better result when sea air is used; but this is only natural, seeing exhaustive tests prove beyond question that an appreciable amount of ozone exists in the atmosphere contiguous to the sea, while on the other hand it is almost entirely absent in that over the land.

Now to proceed to the artificial and commercial application of the gas. Bunsen did not exaggerate when he affirmed that hundreds of uses could be found for it. There are numerous operations in our great textile manufactures where oxidants have to be employed; the process of bleaching is an oxidising of the crude coloring matter; and it is of the utmost importance that this shall be done thoroughly and without injury to the fibres of the fabric. The drying of oils, paints and varnishes, and the rapid finishing of certain manufactures which now takes weeks, require the use of oxidants; and these must be so selected that they introduce no extraneous or injurious substances. They have also sanitary and disinfecting applications, their active principle being to oxidise or literally burn up the offensive and infectious germs. Many more cases there are where different species of oxidants are in present and extensive use, but we cannot enumerate them now; and a little reflection will enable the interested reader to collect them for himself.

Now, ozone can do all and more than can be done by the many and various oxidizing agents. It is more rapid and energetic in its action, consists of nothing else but oxygen, and, therefore, cannot injure or adulterate. It is the very prince of oxidants. The reason why is not far to seek; it is its own solvent or menstruum. No ulterior medium is required to carry and present the necessary amount of free oxygen in a suitable degree of latency, nor does this obliging agent demand the substitution in itself of some other matter in exchange for that portion of its own substance of which it is despoiled. Instead, the transformed and overladen molecule of the operating gas lightly holds its additional atom, ready to yield it up to the absorbent body at the slightest provocation or inducement. And thus both the medium and the active principle of the agent are oxygen, and purely oxygen; nothing more need be introduced. Here there is no compulsory adulteration with other constituents, which, in so many cases, we are obliged to tolerate, even when they harm and deteriorate the material to which the oxidizing principle has to be applied. Here is something of truly immense concern in the bleaching of sugar, of pulp and of some textile fabric where it is absolutely necessary that the original purity of the material treated must be preserved and jealously guarded from the intrusion of anything alien or destructive to its nature.

Its coming into use for industrial purposes would, at one grand stroke, sweep away mountains of obstacles from the path of progress and deliver us from a small occupying army of useful, but dangerous chemical agents, whose terrible sideplay of adulteration and destruction militates so seriously against their value in the work for which we require them, and which all the arduous labor of a long range of years has only been able partially to meet and overcome. One new use is the deodorizing and precipitation of sewage. Our experiments in this direction show that ozone can be most successfully applied for this purpose.



TELEPHONES ON SHIPBOARD.

Telephones on Shipboard.

The Société Générale des Téléphones, says London *Engineering*, have erected a considerable number of installations on board ship to enable communication to be maintained between the various parts with greater facility than by the use of speaking tubes. These latter are more difficult to erect than electric conductors, especially in ships of war, which are divided into many compartments and are more susceptible to damage in action. Among the more important ships already fitted are the vessels of the Compagnie Générale Transatlantique, and the ironclads "Devastation," "Redoubtable," "Amiral Duperre," "Courbet," "Amiral Baudin," the cruiser "Cecille," the torpedo cruiser "Sfax" and the Spanish ironclad "Pelayo." This latter vessel we illustrate on this page.

It will be seen (Fig. 1) that all the circuits radiate from the conning tower A, the arrangement being shown diagrammatically to render it more intelligible. From this place it is possible to communicate with the wheel B, the engine-room C, (3) the foretop D, (4) the torpedoes E E, and (5) the guns F F. Care has been taken to make every part as strong as possible and to avoid all chance of breakdown. To these ends the conductors are made of copper ribbon carefully varnished and efficiently insulated, and to avoid contact, as far as possible, complete and independent circuits are run for the bells and for speaking purposes. In those cases in which an officer or a man has two lines through which he can speak, each line is provided with its own complete apparatus for sending and receiving, and no attempt is made to make one apparatus serve for both lines. By this arrangement all liability to mistake is prevented, and if one instrument should be damaged the other may still remain intact and useful. This principle is sometimes adopted even in the conning tower, but ordinarily there are so many lines emanating from these that it is more convenient to use a switchboard. The telephonic apparatus (Figs. 2 and 3) includes a "Berthon" microphone and an "Ader" receiver connected by a handle; a second "Ader" receiver (Fig. 3) is used where the surrounding noise would interfere with properly hearing with one ear. But experiments on board the "Devastation" proved that with this apparatus a conversation was not interrupted between the conning tower and the central battery, even during the firing of the heavy guns. The "Berthon" microphone is so constructed that damp has no influence upon it. This is also the case with the "Ader" receiver, the coils of which are let into a bituminous block. On board the "Devastation" an apparatus has been used after having been immersed in a pail full of sea water.

Fig. 2 shows a double station connected to two single stations. Fig. 3 is a prospective view of the double station. The single station has the following parts fixed to a wooden board in an iron or wooden casing, call-bell arrangement G, entirely metal, call-key, induction coil, combined "Berthon-Ader" apparatus J, a second receiver and an automatical switch K, from which the combined apparatus is suspended, L. The microphone battery, consisting of two Léclanché Agar-Agar cells (dry cells) is placed in the bottom of the casing.

The double station has all the above apparatus in duplicate; in fact, it is a combination of two single stations in one casing, only the microphone battery serves the two lines. The call-bells have different sounds so as to distinguish them from one another.

Interesting Letter From a War-Time Telegraph Operator.

MR. FRANK B. KNIGHT RECOUNTS HIS EXPERIENCES WITH GEN. GRANT.

TO THE EDITOR OF ELECTRICAL REVIEW:

Twenty-three years ago this Summer was held in Chicago the National Republican Convention which nominated General Grant for president the first time. I was then an operator in the office of the Western Union Telegraph Company, at Chicago, and was one of three or four detailed to transmit to an expectant world the proceedings of that convention. How much changed the method of reporting such events must have become can be partly judged when it is known that at each of the nominating conventions of the two principal political parties held in recent years the services of something over a hundred operators have been called into requisition. To be permitted to witness such an assemblage, composed in part of many of the most distinguished men of the time, from every walk of life, was, to my youthful fancy, no slight privilege, and, after the lapse of the intervening years, I am still inclined to think that I was especially favored. The work of the convention completed, no elections of importance were to occur until those held in October in a few of the States, such as Indiana, Ohio, Pennsylvania, etc., and it was popularly supposed that the results of the elections in these States would indicate pretty clearly what might be expected in the presidential election to occur in the November following, and, naturally, General Grant, who was then at his home in Galena, as well as his friends, were anxious to get the news of these results as soon as possible. While busily engaged at my desk one day, I was summoned to the office of Col. J. S. Wilson, then district superintendent of the Western Union Company, at Chicago. I found there besides Colonel Wilson, General Stager and the Hon. E. B. Washburne. Colonel Wilson asked me if I would go to Galena to take the election returns for General Grant, and stated that it was his and General Stager's desire that I should. I eagerly assented, whereupon I was presented to Mr. Washburne. The day following I arrived in Galena, and upon investigation found it impracticable to run the wires into General Grant's residence, as had been the intention. Upon consultation with the General and Mr. Washburne, it was concluded to utilize the library of the residence of the latter as a telegraph office, which was done. My recollections of that first visit are somewhat hazy. I *do* distinctly remember that the work was not easy. As the time for the November elections drew near, Mr. Washburne requested Colonel Wilson to again have me go to Galena, which I did. For five days I was a guest at Mr. Washburne's house, but there was incessant work day and night, with barely time to take a hasty meal. For three days and nights General Grant was rarely absent from that room. I had met him several times during my service in the military telegraph corps during the war, under circumstances, however, which he was not likely to remember, but mention of the fact by me elicited from him a few vigorously complimentary remarks regarding the men comprising that corps and the effective and loyal service its members had rendered the government. His manner during this time seemed preoccupied and grave, through which, however, would occasionally break a gleam of humor, as once, when his then youthful son Jesse unwittingly touched with his fingers the two binding posts of the main line, which startled more than it hurt him, but which nevertheless brought forth a lusty howl, somewhat to the General's amusement, which he plainly showed in the twinkle of his eye and the words of admonition directed to the boy. I remember, too, of seeing there Nellie Grant, then a fair-haired miss of perhaps eight or nine years of age, and towards whom the General showed marks of unusual affection.

The main part of the work was, of course, the receipt of the election returns in detail from the various parts of the country. These would be eagerly scanned by those present, among them many men famous in civil and military life whose names, however, at this late day, I fail to recollect, with the exception of Mr. Washburne, Senator Allison and Generals Rawlins and Badeau. The returns were tabulated, comparisons made and results announced, but through it all General Grant appeared the least interested of any one in the room. Occasionally would come a telegram addressed to the General, expressing a hope or announcing a decisive victory, and as the result became less a matter of speculation, congratulatory telegrams were received by the score. After having read one of these, the General would almost invariably lay it again upon my table. Many of them I kept for years, but, with the exception of one, they have been given away as souvenirs or lost. The one I have is from John M. T. Williams, Chairman Massachusetts Republican State Committee.

When, finally, it was certain that General Grant was elected, his neighbors and friends began to assemble in front of Mr. Washburne's residence and Senator Allison and others delivered speeches. General Grant had then gone to his own house, where the crowd soon followed and an informal reception was held. I also went, in company with a correspondent of one of the New York papers. Mrs. Grant received us most graciously. The correspondent, with the persistence for which his craft is famous, was determined to have an interview with her. This she finally good-naturedly granted him, although the occasion was one where the demands upon her time were most exacting. The home of the Grants was of red brick, square in shape, and was presented, I think, to General Grant by his friends in Galena. I have a picture of it, procured by me on the occasion of my second visit to Galena. General Grant and his son Fred appear in the picture standing on the porch.

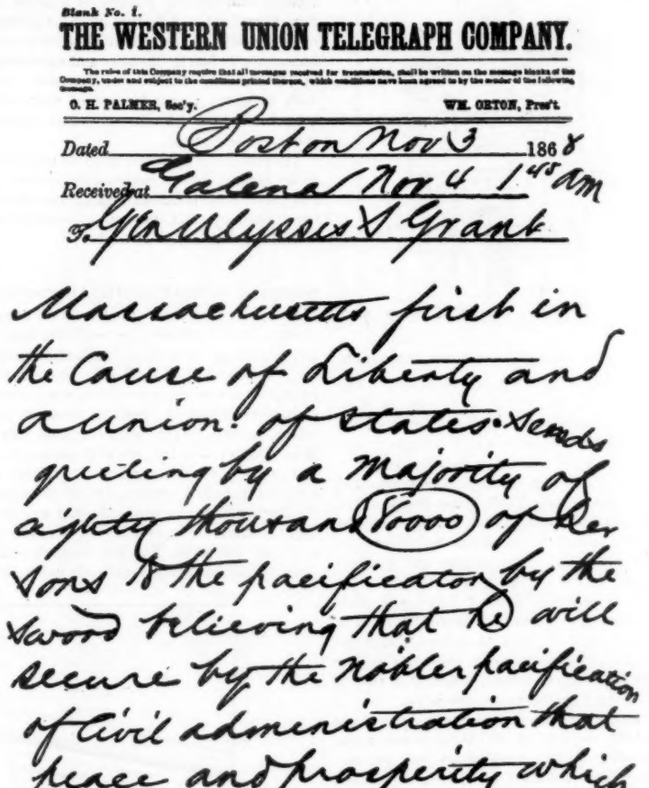
My stay at the house of Mr. Washburne was rendered agreeable in every possible way by that gentleman and members of his household, and on my return to Chicago from my first visit I took occasion to acknowledge my obligations in a brief note. This brought from Mr. Washburne a courteous reply, and enclosed was a *carte de visite* of General Grant, upon which the General had inscribed his autograph. This, Mr. Washburne stated, General Grant sent me with his compliments. The letter and the picture are still in my possession. General Badeau also gave me a photograph of General Grant, which I afterwards presented to a friend.

In after years I met General Grant several times, and an allusion to the incidents of my visits to Galena did not fail to draw from him expressions which showed conclusively that he had by no means forgotten the circumstances. One of these meetings with General Grant occurred at Omaha, when he was returning from his trip around the world. In company with the late General Crook, then commanding the military department of the Platte, and Gen. Charles F. Manderson, recently elected president *pro em.* of the United States Senate, I called upon General Grant at his hotel. There were no other persons present and I am bound to say that the conversation was largely monopolized by the two gentlemen mentioned, General Grant seeming to be particularly reticent. Not so on another occasion when I met him at the Rector street station of the elevated road in New York and rode as far as Fifty-seventh street in the seat next his. I had but lately returned from a visit to the Northwest and had met at Green Bay, Wis., Mr. and Mrs. Sartoris. Upon mentioning this fact to General Grant, he was at once interested, asked me many questions and I found him quite talkative. Few people on the car seemed to recognize him, although he had then, I supposed, become quite a familiar figure in New York.

I think it quite likely that the incidents narrated herein may not impress the general reader as of any great consequence, and, except that they pertain to an important period in the career of one of the greatest of the world's heroes, they would hardly bear passing mention. To me, however, then a young man in my teens, it was something of an event to be in daily association with this grand man and patriot, whose deeds are the proud heritage of a united and prosperous nation.

FRANK B. KNIGHT.

AUSTIN, TEX., April 11, 1891.



Blank No. 1.

THE WESTERN UNION TELEGRAPH COMPANY.

The rules of this Company require that all messages received for transmission, shall be written on the message blanks of the Company, under and subject to the conditions printed thereon, which conditions have been agreed to by the sender of the following message.

O. H. PALMER, Sec'y. WM. ORTON, Pres't.

Dated Boston Nov 3 1868

Received at Galena Nov 4 1.45 am

To Gen Ulysses S Grant

Massachusetts first in the Cause of Liberty and a union of states sends greeting by a Majority of eighty thousand (80000) of her sons & the pacification by the sword believing that it will secure by the ballot pacification of civil administration that peace and prosperity which their fathers guaranteed through a government based on Equal rights John M Williams

FAC-SIMILE OF TELEGRAM TAKEN OFF THE WIRES AT GALENA BY MR. KNIGHT.—FROM THE CHAIRMAN OF MASSACHUSETTS REPUBLICAN STATE COMMITTEE.

TELEGRAPHIC.

.... Samuel J. Stillwell is building the telegraph line along the Great Northern Railroad from Sedro, Wash., to the boundary, at the rate of two miles a day.

.... The difficulty between the London Post Office and the Messenger Companies has ended in a compromise. The Post Office preserves its rights, and at the same time the companies will be enabled to earn a dividend. The Boy Messengers Company will receive a license under the Telegraphs Act.

.... Commenting on the recent troubles between the English Post Office authorities and the district messenger companies, the New York *Sun* says: "Under the constitutional power of Congress to establish Post Offices and post roads, it is possible that the Federal Government could, if Congress saw fit, assume absolute and exclusive control of the carrying business now done by the various messenger companies; but happily there is no prospect that it will attempt to do so."

NEWS FROM CANADA.

AN OCCASIONAL CORRESPONDENT SENDS THE LATEST ELECTRICAL NEWS.—AN IMMENSE POWER SCHEME.

Though so ill treated by our American cousins in everything "reciprocal," though so harshly handled by McKinley, we still live.

Let the Eagle get ready his articulation for he is simply "not in it." The great that was "Niagara tunnel scheme" must pass into the whence that has been. Canada has come to the front in a greater power scheme that will eclipse the American and go it one better.

The Niagara and Queenston Land and Electric Company (Limited), a Toronto organization, propose to lay a canal from two miles above Niagara Falls, beginning at the mouth of the Chippewa River and thence along the high lands to Queenston Heights, located where stands Brock's monument, just above Lewiston, N.Y. By laying the proposed canal the company obtain a fall of 320 feet, or double the fall obtained at Niagara itself. They propose to make the canal of sufficient capacity to supply 100,000 horse-power. If any surplus of power shall be on demand after Canadian interests are supplied, the company may be induced to export some of it to the "States."

This scheme is not an electric one only, but a great water-power plant by means of which a manufacturing city is expected to be built.

The Hamilton Electric Light Company has been in a bad way financially for some time back. The holders of a mortgage on the property, the Freehold Loan and Trust Company, of Toronto, recently sold the property to clear the mortgage; $91,500 was bid, when the sale was closed by the mortgage, on a reserve bid of $100,000. Later in the day, however, representatives of Toronto capital bought the plant for $92,000. The plant is capable of earning a good dividend if properly managed. It has a capacity of 400 arc lights and about 3,000 incandescents, alternating.

We are looking forward with considerable pleasure and are busy with preparations for the coming electric light convention in Montreal. The occasion should be considered an "outing" by all who come, and we hope the number may eclipse the later American gatherings. They will take away with them memories of a pleasant occasion, we feel sure, and in addition will gain much knowledge of a country little understood by Americans generally.

CANADA.

Toronto, Ont., April 25, 1891.

* * Fidalgo Island, Wash., has an electric railway line 12 miles long.

* * Work on the laying of the track of the Ottawa, Can., Electric Railway was commenced last week.

* * The directors of the East Middlesex, Mass., street railway are perfecting plans for the equipment of their road from Woburn to Chelsea with electricity.

* * A company has been incorporated at Painesville for the purpose of constructing an electric street railway between Painesville, Richmond and Fairport, Ohio. It is composed entirely of local capitalists.

* * The Electrical Construction and Manufacturing Company, of Baltimore City, has made an assignment for the benefit of creditors to Alfred J. Carr, trustee. The bond is for $8,000, indicating assets at half that amount.

* * The People's Street Car Company, of Scranton, Pa., has just received a new palace street car named "The City of Scranton," which will be used over the company's lines by the president and board of directors of the company.

* * The Electric Development Company, of San Francisco, Cal., has petitioned the Superior Court that it be dissolved and be allowed to surrender its corporate franchise. The corporation was organized May 12, 1887, with $250,000 capital in 250 shares, all of which is owned by A. H. Reece.

* * The Hudson River Telephone Company, of Albany, N. Y., has decided to build a metallic circuit copper line from Hoosick Falls to Troy and Albany, and similar lines from Saratoga to Albany *via* Schenectady, and from Troy to Albany. Contracts have already been awarded for the last two lines.

* * Since the South St. Louis electric line has been in operation it is surprising to see the decline in the patronage of the Iron Mountain accommodation trains. It is said that the falling off of the passenger traffic has reached 90 per cent. The next time card issued by the Iron Mountain Railway Company will, no doubt, present a less number of trains plying between St. Louis and Carondelet.—*St. Louis Dispatch.*

* * The Transcontinental Street Railway Company, recently purchased by the Willamette Bridge Railway Company, have just closed a contract with the Thomson-Houston Electric Company for 25 special street car equipments. The cars will be double truck pattern, made by the Pullman Company. The Union Power Company, recently organized in Portland, Ore., by leading capitalists, will furnish power for the operation of the Transcontinental Street Railway Company and the Multonomah Street Railway Company. They also expect to run a power circuit for the operation of stationary motors for commercial purposes.

* * The fifth annual report of the Niagara Falls Park Commissioners, which was brought down last week in the Ontario, Canada, legislature, in reference to utilizing the power of Niagara Falls, says that he commissioners, with the consent of the government, have made an agreement with a strong syndicate of English capitalists, the owners of large electrical works at Deptford, England, whose object is to generate and transmit electricity at high voltage for motive power, lighting and general purposes to cities, towns and manufacturing points within a radius of 150 miles from Niagara Falls. The syndicate is to pay for such a privilege $25,000 per annum for the first 10 years, the rental increasing to $35,000 in the twentieth year.

A Large Electric Light Installation by the Excelsior Electric Company.

Brooklyn is known to the average man as New York's dormitory. Dormitory conveys with it an idea of sleep, calm and quiet. A little excursion across our big bridge will disabuse the mind of the average man of the idea that Brooklyn is not thoroughly alive. Development over there is steady, slow and strong, but none the less certain and healthy. Among the many solid financial institutions of the city of churches are the dry goods houses, and among these none stands better than that of S. Wechsler & Brother, who have just moved into the elegant new Offerman Building, on Fulton street near Duffield. Our illustration, Fig. 1, gives a very good idea of the appearance of the front of the building. It is equipped with every modern convenience known to

FIG. 1.—OFFERMAN BUILDING, BROOKLYN.

constructors of business buildings. The architect is Mr. P. J. Lauritzen, of New York, whose work as the designer of the Manhattan Athletic Club building, and others equally famous, is well known.

The Excelsior Electric Company, 115 Broadway, New York, have installed the electric light plant, which is fully up to the high standard of excellence maintained by this company. The engine and dynamo room, shown in Fig. 2, is in the basement of the building, is very large and well ventilated and has a concrete floor. The boiler room is back of and adjoining the engine and dynamo room, and contains four 120 horse-power return tubular steel boilers made by Vogt Brothers, Brooklyn.

There are three Ball high speed automatic cut-off engines of 65 horse-power each, running at 300 revolutions per minute. They were installed by Charles R. Vincent

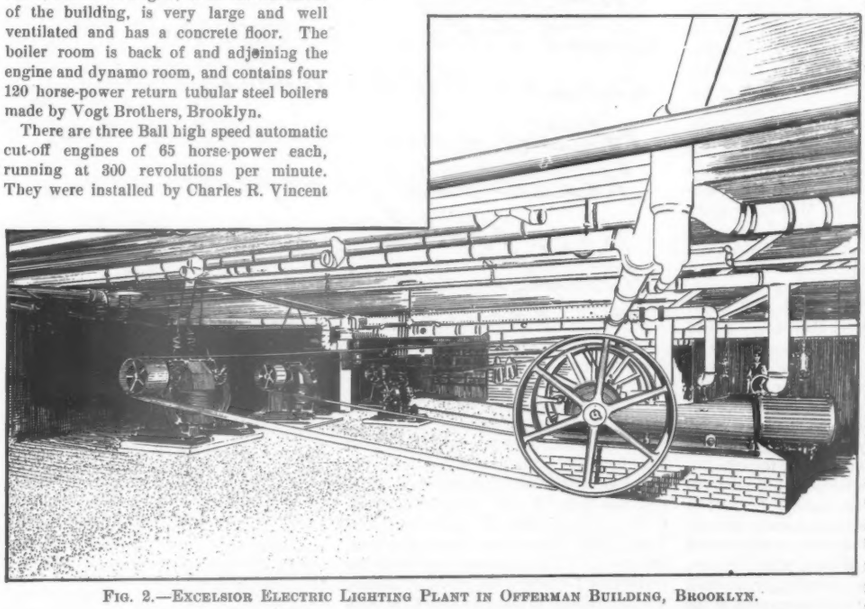


FIG. 2.—EXCELSIOR ELECTRIC LIGHTING PLANT IN OFFERMAN BUILDING, BROOKLYN.

& Company, New York. Chas. A. Schieren & Company's perforated electric leather belting is used on all the dynamos.

The generating plant consists of three 600 light Excelsior incandescent dynamos designed to run at 750 revolutions per minute and one 30 light Excelsior arc machine to run at 1,100 revolutions per minute. The arc lights are of 2,000 candle-power each.

In Fig. 3 the switchboard, a remarkably good piece of construction work, is shown. The Excelsior Electric Company's incandescent switches are used exclusively. These are fitted with common arc light carbon points, and so arranged that in breaking the spark is thrown to the carbon points, thus preventing any sparking of the metal parts of the switch. The regulators are arranged to automatically control the dynamos, both as to quantity and voltage of current. A variation of one-half a volt will operate the regulators, which also compensate for any irregularities due to fluctuation in the speed of the engines. The switchboard is of wood, backed by an ample air space. The distribution is so arranged that each floor is separately controlled, either from that floor or the dynamo room.

The building is wired for between 1,800 and 2,000 lights, the best Grimshaw white core rubber covered wire being used. The tubes of the Interior Conduit and Insulation Company, New York, are used throughout the building. There are wall pockets on each floor containing controlling switches for the lights on that floor.

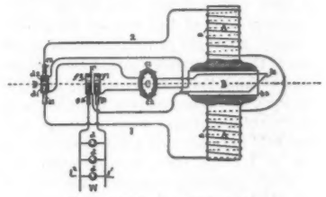
The electroliers and other fixtures are of modern and tasteful designs by Cassidy & Son, New York. A feature of the lighting of the building is the illumination of a well hole about 40 feet in diameter and extending up 160 feet from the floor to the roof. At each floor the circumference of this well hole is studded with incandescent lights, about 300 being used.

Altogether the plant is a splendid example of the highest class of electrical engineering, and great credit is due to the Excelsior Electric Company and the other companies named for their excellent work.

Stanley's Constant Potential Alternator.

Alternating current generators as commonly constructed are provided with auxiliary generators for exciting the field magnetism. An incident of such a method of field excitation is that the potential in the supply circuit varies with the speed of the armature which in turn varies with the load. Mr. Wm. Stanley, Jr., has recently patented a self exciting generator, adapted to deliver a constant potential irrespective of the load. As illustrated in the accompanying engraving, the armature is wound with two sets of coils, one of which has its terminals connected with the field-magnet coils, while the other set of coils is connected with the work circuit. An electric converter has one coil connected in the circuit of the armature coils supplying the field-magnet and its other coil in the circuit of the armature coil supplying the work circuit. This converter may with advantage be carried upon and revolve with the armature shaft. A rectifying commutator is interposed in the field-magnet circuit for the purpose of rendering the currents delivered to the field-magnet coils continuous in direction.

The armature is provided with two sets of armature coils b^1 b^2, placed at right angles to each other. The coil b^1 has one terminal connected, through the coils c^1 of an electric converter, to one plate of a rectifying commutator D. The converter is mounted upon the armature shaft and revolves therewith. The other terminal of the coil b^1 is connected directly with the other plate of the commutator. Two commutator brushes e^1 e^2 make alternate connections with the commutator plates, and connect with the field-magnet coils. One terminal of the second set of armature coils b^2 is connected through the second coil c^2 of the converter C with a contact or collecting ring f^1 of the collector F. The other terminal of the coil b^2 is connected with the remaining ring f^2 of the collector. The brushes g^1 g^2, respectively, applied to the collector rings, are connected to the main lines L^1 L^2, supplying a work circuit W. Considering, first, that the work circuit is open and no work is being done, then the revolution of the armature will cause an electromotive force to be developed in the



STANLEY'S ALTERNATOR.

coil b^1 and a current will be caused to traverse the coil c^1 of the converter C, passing thence to the field-magnet. This current will be opposed by a counter electromotive force developed in the converter in a manner well understood. The current traversing the field-magnet coils will, therefore, be comparatively small. If now the work circuit is closed, a current will be allowed to traverse that circuit dependent upon the resistance encountered. This current also traverses the coil c^2 of the converter. The two currents being generated in coils placed at right angles to each other, will have their phases 90 degrees apart and tend to mutually destroy the counter electromotive force or self-induction of each other. When, therefore, currents traverse the coil c^2, the effective counter electromotive force or self-induction opposed to the passage of current through the coil c^1 is diminished and more current is allowed to flow through that coil. Moreover, the presence of the current in the coil c^1 serves to neutralize the opposing force, which would otherwise tend to prevent the passage of current through the coil c^2. As the difference of potential at the terminals of the coil c^1 decreases, that at the terminals of the field-magnet increases, and *vice versa*. Therefore, more current will be allowed to flow through the field-magnet coils as the resistance of the work circuit is diminished, thus increasing the field of force of the generator with an increase of load. When the resistance of the work circuit is increased by lessening the work being done, less current will flow through coil c^2, and, therefore, less through coil c^1, thus decreasing correspondingly the field-magnet strength. Coil c^1 is preferably of fine wire and coil c^2 of coarse wire.

Combination motor and passenger, open and closed, 32 foot cars are used by the Oakland and Berkeley, Cal., Rapid Transit Company.

ELECTRIC CLUBS.

New York Electric Club.

The New Board of Managers held its first meeting April 30, at 8.30 P. M., with President Samuel Insull in the chair.

Committees were appointed as follows: House committee, P. H. Alexander, chairman; Chas. D. Shain and Stephen L. Coles. Entertainment committee, T. C. Martin, C. E. Stump, Chas. W. Price and two others to be appointed at the next meeting of the board. Finance committee, President Insull, chairman; Geo. M. Phelps and P. H. Alexander. Electrical committee, Chas. D. Shain, E. A. Leslie and Herbert Laws Webb. Library committee, Edward Weston, Joseph Wetzler and Stephen L. Coles. The reception committee will be appointed at the next meeting of the board.

The Membership Committee will hold a meeting shortly to act upon a large number of applications.

The Privileges of the Club will be tendered the American Institute of Electrical Engineers during its annual meeting this month.

American Institute of Electrical Engineers.

The Spring Meetings of the Institute will be held on May 19, 20 and 21, at its headquarters, No. 12 West Thirty-first street, New York city. The preliminary programme, as arranged by the Committee on Papers and Meetings and the Local Committee of Arrangements, is as follows:

The regular monthly meeting of council will be held in the secretary's office at 5 P. M., May 19.

The annual meeting for the presentation of reports, election of officers and other business will follow at 8 P. M., on the same date.

The morning session, May 20, will assemble at 10 o'clock, when the following papers will be read:

"The Development of the Dynamo," by Prof. Harris J. Ryan. "Evolution of the Stationary Electric Motor," by Dr. S. S. Wheeler. "Some Data Concerning the Photometry of the Arc Lamp," by Prof. E. L. Nichols.

Afternoon session, May 20: "A New Graphical Method of Calculating Leads for Wiring," by Mr. Carl Hering. "Street Car Motor Design," by H. F. Parshall. "A Proposed Electrical Equipment for the Coming Rapid Transit System of New York City," by Frank J. Sprague.

Evening session at Columbia College. "Experiments with Alternating Currents of High Frequency," by Mr. Nikola Tesla.

Thursday morning, May 21, the members will meet at the Crocker-Wheeler Motor Company's factory, 430 West Fourteenth street. After an inspection of this establishment, the meeting will reassemble at 12 West Thirty-first street, when the following papers will be read:

"A New Device for the Measurement of Alternating Current Potential," by Prof. Geo. S. Moler. "A Study of the Fluctuations of E. M. F. in the Open Coil Armature of a Constant Current Machine," by Mr. M. E. Thompson. "Some Results in the Practical Utilization of Electric Welding," by Dr. F. A. C. Perrine.

Afternoon session, May 21. "Electric Meters," by G. W. Walker. An address by Dr. W. H. Wahl on "The Aluminum Problem, Retrospective and Prospective," also a paper entitled, "Shall Aluminum be Alium," by Mr. Oberlin Smith. In connection with this subject there will be an exhibit of aluminum products.

Thursday evening a reception will be tendered to the Institute by the Electric Club.

Visits to different electrical establishments and objects of interest will also be arranged for Friday, May 22, an announcement of which will be published in the official programme.

The Franklin Club, of Newark.

The Thirtieth Regular Meeting of the Franklin Experimental Club, of Newark, was held at the Club Laboratory, No. 6 Bloomfield avenue, Tuesday evening, the 21st inst.

The speaker of the evening was Francis R. Upton who read a paper entitled "The Possibilities of Electricity."

Mr. Upton began by speaking of the helplessness of the human being until he had called to his aid the powers of nature. After briefly noting the forces which, one by one, had been brought under the control of man, he spoke of that most wonderful of all in the service of man, the electrical energy.

The speaker described his early experiences in the electrical field when he first became associated with the development of the incandescent lamp at Menlo Park. He declared that the growth of that industry in extent and efficiency, a growth with which his own business career was closely allied, made him feel prophetic in regard to the future. He stated that the incandescent electric light offered a most promising field for investigation.

Mr. Upton then took up the subject of heating and said that electricity was, theoretically, a perfect agent for the purpose; that it was even now possible to furnish electrically generated heat for domestic purposes, and that it only remained to so reduce the cost of producing heat electrically as to place it on a commercial basis. The speaker went into the subject of the generation and maintenance of power on a large scale, and which could be transported at will and distributed in any desired amounts. Electricity alone, of all forces, has solved this problem. The question of rapid transit was then taken up; also the advance being made in long distance telephony, which promised to make that system a rival of the telegraph in the near future. Mr. Upton brought his paper to a close with the prediction that New York would become the great electrical center of the world, and that the city's growth and development would offer unprecedented opportunities for electrical expansion.

A general discussion followed and was participated in by Messrs. Wm. J. Hammer, Geo B. Webb and Dr. T. W. Corwin. Some novel incandescent lamp experiments were shown by P. W. Hillard and Paul H. Jaehnig. At the next meeting of the Club, the first Tuesday in May, a paper will be read by Wm. J. Hammer, entitled "The Arc Light."

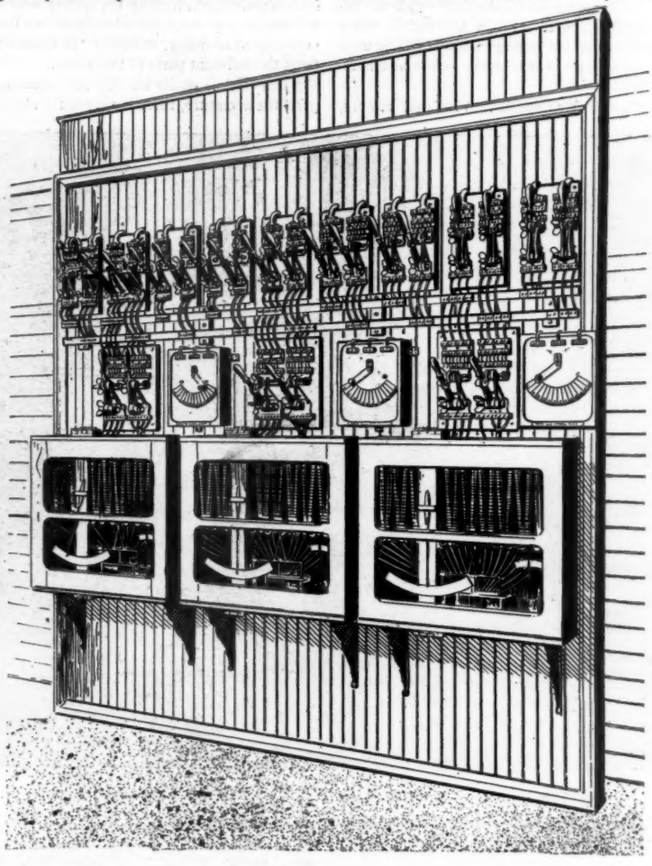


FIG. 3.—SWITCHBOARD OF EXCELSIOR ELECTRIC LIGHTING PLANT IN OFFERMAN BUILDING, BROOKLYN.

The Next Electric Light Convention.

SECRETARY BEANE VISITS MONTREAL AND ARRANGES FOR THE AUGUST MEETING.

Mr. John W. Beane, the secretary and treasurer of the National Electric Light Association, visited Montreal recently to make arrangements and look over the ground for the coming convention and exposition of the association in that city in August. Mr. Beane was taken in charge and entertained by Mr. A. J. Corriveau, of the Canadian Electrical Construction Company, and Mr. Carroll, of the Eugene Phillips Electrical Works, of Montreal, who accompanied him around the city. During the day he paid a visit to Mayor McShane, Hon. Senator Thibaudeau, Prof. Bovey, of McGill University; Mr. Richard White, Mr. Hagar, of the Royal Electric Light Company; Mr. S. C. Stevenson, of the Council of Arts and Manufactures. He was very courteously received by all. He also visited a number of the electric central stations and a number of citizens who are interested in electrical affairs. In the evening he was met at the Windsor by a representative of the Montreal *Gazette*, who asked him what he thought of Montreal for a place in which to hold a convention, and what were the prospects of the future development of business and industry in connection with electricity, both scientific and mechanical. He replied as follows:

"Although my visit to Montreal has been a short one, I have, nevertheless, found to my great satisfaction that your city and country has a big field before it in the way of electrical development. I was very favorably impressed with the electric plants in central stations for lighting purposes, and I found that the city was most beautifully lighted and the lights well disposed. I expected, however, to find that you were using more electrical power transmitted for manufacturing purposes and other uses. I see there are only a few electric motors running from the circuits of the Perrault electric light and power station. But I am pleased to hear that there will be a great many more used in a short time, not only for manufacturing purposes, but also for the running of passenger and freight elevators, etc. I had a very pleasant conversation with Mr. Swett, manager of the Windsor Hotel, in regard to the coming convention. He seems to be willing to do his utmost to make our visit a pleasant one. I also had a conversation with Mr. Henry Hogan in regard to the same purpose. He says he will do his best to give the visitors the best of accommodation. Also had a conversation with him as to the proposed electric elevated road in which himself and Mr. M. Perrault are largely interested. They both expressed themselves as being very well satisfied that in the near future Montreal will have its own elevated railroad run by electricity. I was also very much pleased with my visit to Prof. Bovey, who, I think, has done a great deal to develop electrical science in Canada. This gentleman is well up in the subject. I also was glad to hear of the electrical department which is to be added to McGill. It promises to be a grand addition to the studies now taught at this famous college. Prof Bovey seems to take a very deep interest in the coming convention. I was agreeably surprised in finding such a fine city with your vast number of fine buildings of modern architecture, and I think it is one of the prettiest places I have ever visited, especially your Mountain Park. I also took a look at the Windsor Hall and the Victoria Skating Rink with a view for our exhibition, and I think both are well adapted for the purpose. From what I have heard, the field for the development of water power is a grand one. The vast number of waterfalls gives Canada the grandest chance in the world for the transmission of motive power of every description by electricity."

ELECTRIC LIGHT NEWS

—— The South Pittsburg, Tenn., Electric Light Company is to increase its capacity.

—— The erection of an electric light plant is talked of at Bardstown, Ky., by A. R. Carothers.

—— C. B. Hawley, of Tacoma, has purchased the Centralia, Wash., electric light plant from the Thomson-Houston Company and will make extensive improvements.

—— South Haven, Mich., is to have electric lights. The council has given a ten-years' franchise, with right of purchase, to L. H. and G. F. Harrison, of Paw Paw.

—— Travis Bros., proprietors of the Owosso Electric Light Company have contracted to extend their wires to Corunna, and are negotiating for a franchise at Ithaca, Mich.

—— At a special election held at Far Rockaway, L. I., last week, to vote upon the gas and electric light franchise of Smuck, Torrey and Gamburg, the franchise was defeated. The vote stood 39 for and 57 against.

—— The Citizens' Electric Light Company, of Lansdowne, Pa., have elected the following officers: President, James S. Austin; vice-president, Samuel L. Kent; directors, Edward V. Kane, James Garrett, John Fongar, H. C. Keyes, Dr. J. W. Phillips, John Adams and Thomas Burwell.

—— Sealed proposals will be received by the city of Vallejo, Cal., until May 15, 1891, for lighting the public squares and streets of that city with 30 or more 2,000 candle-power single arc electric lights, the contract to be for five years from date of lighting. To the successful bidder a charter privilege for a period of ten years will be granted for the purposes of private and commercial lighting with the incandescent and arc systems.

—— The Boston *Post* claims that its new building on Washington street is the first concern in Boston, if not in New England, to depend solely on electricity as a means of illumination. There is not a gas pipe in the building. A 260 light Edison dynamo, located in the basement and driven by a special engine, lights the building, and should any accident happen to the machinery from any cause, the simple turning of a switch connects the establishment with the street service.

PERSONAL.

Professor Elihu Thomson spent several days of last week in Philadelphia.

Mr. Elliott O. Johnson, of the Standard Electric Supply Company, Boston, made a short business visit to New York last week.

Mr. Jesse H. Lippincott, the purchaser of the phonograph and graphophone, failed on Monday of this week. His liabilities are estimated at half a million.

Mr John W. Beane, secretary of the National Electric Light Association, was in Montreal last week, looking up matters connected with the August convention.

Prof. J. P. Barrett, electrician of the World's Columbian Exposition, spent a few days in New York last week, and renewed many acquaintances at the Electric Club.

Mr. J. H. Howard, general manager of the Tropical American Telephone Company, was one of the Boston visitors in the metropolis last week, looking after the interests of his busy company.

Mr. P. C. Ackerman, the popular New York representative of the popular American Electrical Works, of Providence, has been absent for several weeks on a San Francisco trip, and is now *en route* home.

Mr. C. J. H. Woodbury, of Boston, widely known in electrical and insurance circles, met with a severe accident in a mill at Raritan, N. J., on April 28. He slipped on a piece of soap and fell on a stairway, badly injuring his back, but it is now thought that there will not be any internal injuries.

Electricity in Mill Work.

EXTRACT FROM PAPER READ APRIL 29, BEFORE THE N. E. COTTON MANUFACTURERS' ASSOCIATION BY MR. O. S. HUSSEY, OF BOSTON.

During the past few years, the applications of electricity to power transmission have increased to such an extent that one can hardly realize it is little more than ten years ago that electricity became of practical use to the commercial world. This increase is due to the great economy obtained in electrical transmission, and to the flexibility of the apparatus employed, when installed under suitable conditions.

Electricity is used to-day for transmitting thousands of horse-power in units as small as ⅛ horse-power, and as large as 300 horse-power, one as successfully as the other, over distances ranging from 500 feet or less to five miles and more.

The question of long distance transmission of power by electricity is one which has only been recently considered by engineers. If a mill is located upon a water power which is only sufficient to furnish enough power for a portion of the year, it has always been considered necessary to put in an engine of sufficient capacity to "help out." The fact that the power of a fall located at some distance from the mill could be utilized at the mill in connection with the power already there, through the medium of electricity, has not even been thought of.

The writer has in mind a mill which is located under similiar conditions. A 1,000 horse-power engine is installed at the mill, and, whenever necessary, is run in connection with the wheels. There is a water power about two miles from the mill of over 2,000 horse-power capacity. How easy it would be to transmit this power to the mill, by proper electrical apparatus, and use it instead of the engine.

One of the large electric companies is at present building a generator and motor for use near Hartford, Connecticut, and the amount of power to be transmitted is 300 horse-power. The source of power is located 10 miles away from where the power is to be utilized, 3,000 volts being used in this case, owing to the great distance carried.

Again, a large paper company, located near Portland, Maine, is driving its entire mill by electric power, which is transmitted a considerable distance. The voltage used in this instance is only 500, as the power is sub-divided into small units and distributed throughout the mill.

The province of this article, however, is not so much the consideration of the subject of long distance transmission as it is to show, if possible, how electric power can be used advantageously in performing some of the work in and about a mill, now done by other means.

This work may be divided under the following heads:

1st. Electricity as applied to isolated motors, located in different parts of a mill, and used to drive lines of shafting, separate machines, etc.

2d. Electricity as applied to driving tram-cars suitable to handling all classes of goods, both in the mill and about the mill yard.

3d. Electricity as applied to hoisting machinery of all descriptions, including elevators, whip and drum hoists, etc.

4th. Electricity as applied to pumping machinery.

Assuming that there is sufficient power at the mill, either steam or water power, let us then consider what is necessary in the way of generators for supplying power to the different electrical apparatus, wherever located.

These machines are built in powers ranging from 10 horse-power to 300 horse-power. They are equipped with self-oiling bearings and sliding bases. These machines, set upon substantial brick or stone foundations and fed with the best dynamo oil, should need practically no attention except at starting and stopping, as the modern generator is so wound that the voltage or electrical pressure is kept constant under any variation of load.

For transmitting over distances, such as would occur about a mill, both generators and motors should be wound for 500 volts, as this would insure the greatest economy in copper wire without danger to persons handling the apparatus.

It is always better, where there are two or more machines in a generating station, to drive each of them from the existing water or steam powers through the medium of a friction clutch; by this means any one of them can be stopped, if necessary, without any other part of the machinery being shut down.

Let us now take up the different heads before enumerated, always bearing in mind the fact that the same generators can be used for all classes of machinery mentioned hereafter.

Electricity as applied to isolated motors, located in different parts of a mill and used to drive lines of shafting, separate machines, etc.

The amount of power which would be saved by doing away with cumbersome jack-shafts, heavy pulleys and dangerous belting has never been considered by many. As a rough approximation, 100 feet of shafting, three inches in diameter, and making 120 revolutions per minute, requires one horse-power to overcome its friction, under conditions of fairly good alignment and good care. Should this shafting become out of alignment, as is frequently the case, its frictional resistance would be proportionally increased.

It has been estimated that from 30 to 50 per cent. of the power generated in mills and factories is unremunerative, because of the wasteful method of driving in vogue at the present time. Should a judicious arrangement of electrical transmission be employed, on the contrary, fully 85 per cent. of the power developed by the wheels would be expended in useful work. That the transmission and distribution of power by electricity is a profitable investment is proven by the large number of electric stations scattered throughout the country and furnishing power to a large number of consumers in small and large units. Not only can power be saved by electrical transmission, but also a large amount of space is made available for other purposes, as an electric motor is of such dimensions that it can be suspended entirely out of reach, if necessary, on shelves or by other means, and driven in this position.

Another point which should be considered by mill men, and which would seem to be a very essential one, is this: By a sub division of shafting into small units, a much more complete control is had over it in case of accident, or of any breakdown which is liable to occur, and which means, as mills are driven to-day, the shutting down of an entire room and sometimes of an entire factory at an immense loss while repairs are being made.

On the contrary should motors in small units be used, simply that portion of the room in which the breakdown occurred would be stopped, the rest of the mill running as before.

It is unnecessary to go to the motor in order to stop it, it being a very simple matter to arrange a supplementary electrical system running throughout the factory which will enable any employé who should see the necessity of so doing, stopping the machine from the different parts of the room.

As an electric motor has but one running part, the armature, there is very little about the machine to get out of order, but should an accident happen to any part of it, this can, under ordinary circumstances, be quickly repaired. If, however, the injury be of such a nature as to render it necessary to send to the manufacturer, a duplicate part could be returned in a comparatively short time.

The question of the spreading of fire in mills is one of great interest to mill owners, and anything that could be devised to aid in preventing this should be carefully considered. One method which naturally suggests itself is to isolate each room in a factory as far as practical, by closing all belt holes in floors and walls, thereby getting rid of that very dangerous element, the risk of carrying fire from floor to floor, and room to room. No better method can be secured to accomplish this than the use of the electricity for transmission. In cases where belt towers are used, the arrangement is generally a very costly one. The danger of fire occurring from the use of electricity has been reduced to a minimum by the many safe-guards and protectors which are to be found in all well installed plants.

By a properly proportioned winding of the armature and fields, automatic regulation of speed of less than two per cent. variation is obtained on all first-class motors, no matter what the variations of load may be. This feature is of special value, as it permits the simplest possible construction of the motor and at the same time secures an automatic regulation of speed well within the range of that which is guaranteed for the best regulated high speed steam engines.

The next head to be considered is the application of electricity for driving tram-cars.

The electric mill tramway, in its sphere, has operated fully as successfully as the electric street railway, although its adoption has not been so general.

As yet many of the mills are not entirely willing to give up their old methods of transporting goods in and about their mill yards by means of hand or horse-power and to install an electric tram-road, the first cost of which will amount to considerable, but after once put in, meaning a saving in operating expenses.

A mill tramway is, practically, a modified electric street railroad, the principle of propulsion being the same. Usually a single overhead trolley system is used, as in street railway work, the electricity being carried from the dynamo to the motors under the cars by means of this trolley; the rails of the track upon which the cars run being used to carry the current back to the generator. Where the motor car is to be run inside of buildings, however, two trolley wires are used; one for the same purpose as before, *i. e.*, to carry the current to the motor, while the second is used for carrying it back, instead of the rails. This is done in order to have a thoroughly insulated system throughout, and to do away with any sparking which might occur between the rails of the track and the revolving car wheels.

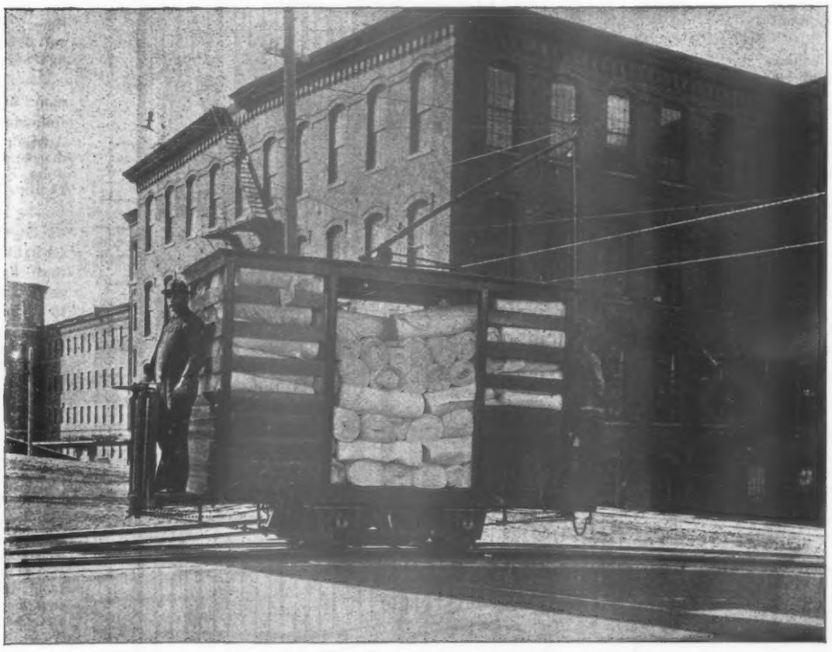


FIG 1.—ELECTRIC TRAMWAY AT THE NASHUA MANUFACTURING COMPANY, NASHUA, N. H.

The amount of power generally used by motor cars in ordinary tramway work is either of three horse-power or six horse-power; the former easily handling a load of 5,000 pounds, and the latter a load of 10,000, exclusive of the weight of the car, at a speed of four miles per hour on a level and straight track. These motors are mounted upon platform trucks of any convenient dimensions. As they are hung from the axles of the trucks, the platform itself is available for carrying the load. These cars can be used for towing other small cars, if desired, thus increasing the carrying capacity of the system very materially.

For hauling heavy loads, such as loaded freight cars, electric locomotives of 30 horse-power and over have been designed. These larger machines are also so constructed that the platform of the machine itself is available for loading, if so desired.

The small motor cars are built to operate on any gauge of track from 30 inches to the standard 4 feet, 8½ inches. The controlling device is extremely simple, and is so placed upon the car that one man operates it with entire control of direction and of speed. Ordinary curves and grades offer no serious objection to the operation of the system, as electric cars are now doing successful work on tracks having curves of less than 15 feet radius and grades of over 12 per cent.

As before stated, the same generator used for furnishing power to stationary motors throughout the mill is equally available for supplying the necessary current for propelling the tram-cars. However, should there be no other work performed about the mill electrically, a generator of sufficient size to operate the tram-road can be placed in the engine room or wheel house, and run directly from the existing power; the engineer or wheelman being perfectly able to give it what little attention it may require, without in any way interfering with its regular duties.

For transporting large and heavy loads

about a mill there are but two other systems besides the electric suitable for the work, *i. e.*, steam and cable tramways.

The former is not desirable, for two reasons: First, the large annual cost for operating a locomotive, as compared with almost any other motive power; Secondly, a locomotive would be dangerous about a cotton or woollen mill, where there is inflammable material liable to take fire by sparks from it; particularly, as is frequently the case, where power is required for both out-door and interior use.

The cable system has disadvantages also. Inasmuch as direction of motion of the cable is always the same, the cars would necessarily always move in the same direction in passing a given point, unless a second track be used having the return cable running in the opposite direction. This, in most mills, would be utterly impracticable and almost impossible.

Again, the cable system is costly in power consumed, because the dead weight of the cable together with its frictional resistance have to be overcome at all times, whether cars are in actual use or not. With an electric system, however, the cost of operating is practically nothing when the car is not in use; when it is, the power consumed is directly proportional to the load carried.

The cost of maintaining a cable system is much greater than that required by an electric, because of greater wear and tear. In fact, the same arguments used in favor of electric street cars over cable cars can be applied to these systems in tramway work; and the best proof of the superiority of the one over the other is shown by there being in August, 1890, 258 electric railways in the United States alone, with 1,927 miles of track and 3,024 cars in daily service or under construction, while cable roads are still comparatively a novelty.

The electric car also far exceeds the steam locomotive in its ability to climb grades. The latter is unable to overcome a rise of over two or three per cent. under favorable conditions; while, as has been stated, electric cars are working successfully on grades of over 12 per cent. This is an additional point greatly to the advantage of the electric system.

The third head to be considered is the application of electricity to hoisting apparatus.

For hoisting work, machines are now made of almost any size and power, from three horse-power whip, suitable for handling light loads at a high rate of speed, to 80 and 100 horse-power machines for heavy work. A description of the 15 horse-power hoist, manufactured by the Thomson-Houston Motor Company, may be of interest to you. It combines a 15 horse-power, especially wound motor and adrum hoist. The outside dimensions of the entire machine are 56⅜ inches by 54⅜ inches. The motor shaft carries a small pinion which engages the first large gear wheel. This, in turn, carries a small pinion on its shaft which meshes into the large gear wheel of the drum. The total speed reduction from the armature shaft to the drum is 29.1.

The friction clutch consists of a stout band of steel, lined with small friction blocks made of wood. The movement of clutch lever tightens this band upon the drum. The connection becomes for the time being positive, but possesses the advantage (and this is where any form of cone clutch is weak) that the disengagement is equally positive, and all danger of the clutch sticking and consequent winding up of the drum too far is avoided.

The length of the controlling arm gives tremendous leverage, and slipping is practically impossible.

The speed of the motor and, consequently, of the hoist is under control through the rheostat, which is placed entirely out of sight under the bed-plate. The segments are connected to the contact board on the side, and the rotation of the contact arm is controlled by rack and pinion. This arrangement does away with a heavy rheostat arm, requiring much muscular effort in its operation, and substitutes an equally effective, while much easier operated, controlling device.

The reversing switch when used is conveniently placed next to the rheostat contact board. The brake, consisting of a heavy iron band, extending almost around the drum circumference, is operated by a foot lever. These hoists are particularly desirable for storehouses and warehouses, because they can be mounted upon trucks and easily moved from one portion of the building to the other, wherever needed. A plant of this description is in use on one of the large docks in Brooklyn. The wharf is wired in all parts, plugs being inserted at intervals, so that the supply of power can be obtained from the main wires at almost any point and at a moment's notice. Flexible wires are used between the mains and hoist motor for conducting the current.

On Constitution Wharf, in Boston, a large 45 horse-power motor is used to drive an elevator and also a long line of shafting running the entire length of the building, from which four friction whip-hoists are operated. These whip-hoists are used in handling light loads rapidly. They are comparatively inexpensive and do away with dummy engines, or of a horse at one end of a rope slowly pulling up a barrel or bale at the other end, consuming a great deal of time, patience and money. These small friction whips, after the design used at Constitution Wharf, should receive the approval of mill men for use in cotton, wool or cloth storehouses. To-day, in a great many places, a dozen or more men are required to do the same amount of work that two men with a whip-hoist could perform more quickly and easily.

An arrangement has been designed by the Thomson-Houston Motor Company, in which a traveling overhead trolley carriage is used in connection with the friction hoist. With this arrangement a load can be picked up at one part of the storehouse and deposited in another part at any height desired.

It might be well to again state the fact that the freedom from danger of fire is a great point in favor of electric hoists, especially where cotton and wool are to be handled.

Within the past year electricity has been applied successfully to elevators and special machines have been designed for this work. The hoisting drum is mounted upon the same bed-plate as the motor, and is driven by means of worm gearing. The worm-shaft is connected directly to the armature shaft by a coupling, insuring positive motion between the motor and hoisting drum.

The principal feature of the machine, however, is the fact that the motor being so controlled by means of a suitable controlling device, operated from the car, that it is made to revolve in either direction, running the car up or down as desired. As the motor is entirely at rest when the elevator is not in use, it consumes no power except when the elevator is actually running. A saving of power is hereby effected in this form over any form of belt machine which can be used. The electric elevator can be operated at any speed from slow-moving freight elevator, running at a speed of 50 feet per minute, to the rapidly moving passenger machine, running at a speed of 800 feet per minute.

The fourth and last head to be considered is the application of electricity to power pumps.

While the question of adapting electricity to pumping may not have so much interest to mill men in general as the previous points brought up, still it may be of sufficient interest to warrant bringing to your attention a form of pump which is being used to a great extent by the Thomson-Houston Motor Company in connection with its motors.

This pump is manufactured by the Goulds Manufacturing Company, of Seneca Falls, N. Y., and is of the triplex, single acting type. Three single-acting plungers, with their cranks hung from the main shaft at 120 degrees, are worked in three vertical cylinders.

This arrangement is the best possible one for electric work, as it insures an almost constant load upon the motor at all points of the stroke. The Goulds Manufacturing Company makes pumps of this design in all sizes from two inch by four inch cylinders for light work, to 12 inch by 12 inch in course of design. The efficiency of these electric pumps has been shown by actual test to be fully equal to that of a steam pump of corresponding capacity and working under similar conditions.

The smaller sizes of this pump are particularly adapted for fire purposes, as they can be distributed in different parts of the mill, power being carried to them by wires from the generator. They are always ready to be operated, and, because of their small size, can be placed in such a position as to be entirely out of the way of the every-day operations of the mill.

Also electric pumps are intended to supersede steam pumps of any size, particularly if the location of the pump is any great distance from the source of power. With the efficiency the same, the electric pump can be operated much more economically, owing to the small loss in power experienced in transmitting electricity, as compared to the loss in transmitting steam an equal distance.

The advantage of the electrical system of power distribution in regular work has been shown to be as follows:

It permits the utilization of water powers situated at distant or inaccessible points. In the absence of water-power, electric transmission renders a concentration of steam plants possible. Small, expensive and, perhaps, troublesome steam plants are done away with, and in their place is a large well equipped and economical central station, from which the required amount of power, with small loss, is conveyed to the different motors wherever placed.

FIG. 2.—ELECTRIC TRAMWAY AT THE JACKSON MANUFACTURING COMPANY, NASHUA, N. H.

OUR INDIANAPOLIS LETTER.

The Indianapolis and Broad Ripple Rapid Transit Company has recently secured a franchise for the construction of an electric street railroad from Indianapolis to Broad Ripple, a suburb some nine miles from the center of the city, and has contracted with the Edison General Electric Company for the construction and equipment of the road.

The Citizens' Street Railroad Company, which is now operating an overhead, single trolley, Thomson-Houston system on Illinois street from the Union Railway Station to Fairview Park, some four and one-half miles, and a storage battery system of two cars on the Irvington line, some three miles in length, is about to extend its electrical equipment to other lines in the city; and will probably first equip the lines in the vicinity of the proposed Indianapolis & Broad Ripple road.

Mr. Charles D. Jenney, formerly of the Indianapolis Jenney Electric Light Company, is manufacturing and selling a large number of motors of an improved pattern, and reports that his business in this line is constantly increasing and crowding the capacity of his manufactory.

The Contract between the city and the Brush Electric Light Company for street lighting expired some few months ago, since which time proposals have been solicited for lighting the streets for a term of years, or constructing a plant for such lighting which shall, at the expiration of a specified number of years, become the property of the city. No contract as yet has been entered into, and the Brush Electric Light Company, which formerly had the contract for street lighting, still continues with charming regularity to light the streets from twilight to dawn under an agreement with the city authorities to pay an indefinite amount for the same.

The Marmon & Perry Electric Company, which operates a large plant for incandescent electric lighting, and which has its wires in conduits underground, is doing a good and increasing business. It is said that the Brush Company has a contract giving it the right to use the conduits of the Marmon & Perry Company for both street and commercial lighting and thus has an advantage in contracting with the city for street lighting.

The Western Union Telegraph Company has put in a number of clocks under the system inaugurated by that company for furnishing standard time from the Washington Observatory. The system is giving universal satisfaction and is constantly increasing in popularity.

The Officials of the Central Union Telephone Company report that business of the company in this city and the State has recovered from the ill effects of the rate law passed some years ago, and is constantly increasing, the Indianapolis exchange having 350 subscribers more than it had at the time the telephone law was adopted. The preservation of the property and the present prosperous condition of affairs is largely due to the efforts of the State superintendent, Mr. Hockett, and the manager of the Indianapolis exchange, Mr. Hough, who have been with the company through its tribulations under the operation of the telephone rate law. It is reported that these efficient officials of the telephone company are about to retire from its service, and that they are to be succeeded by others late of the B. & O. telegraph service.

Several New Firms are about to embark in the general electric business, a field which in this vicinity appears to lack cultivation.

ELECTRIC.

Indianapolis, April 25, 1891.

KINDRED INTERESTS

The Electrical Manufacturing Company, Dayton, Ohio, have issued a handsome pamphlet catalogue describing their products, which include Fletcher's specialties.

The Pacific Telephone and Telegraph Company, San Francisco, have sent us a list of subscribers issued for April, 1891. It is well edited and executed, and is considerably larger than previous issues.

McIntosh, Seymour & Company, Auburn, N. Y., manufacturers of the well-known automatic cut-off engines of that name, report that although they are running their large plant 23 hours out of every 24, they are considerably behind with their orders.

The Joseph Dixon Crucible Company, Jersey City, N. J., are sending out a handsome advertising card, showing in colored inks the various styles of lead pencils made by them. Electrical people should use these good lead pencils; this is written with one of them.

Interior Conduit.—The Milwaukee Board of Fire Underwriters have just compiled a set of rules governing electric light wiring, and have in so doing made several very good points, one of which is the complete and thorough way of using the interior conduit system of the Interior Conduit and Insulation Company, New York.

Mr. Louis Walsh, a gentleman of much experience in battery matters, will have charge of the battery department of Alexander, Barney & Chapin, 18 Cortlandt street, New York. Mr. Walsh will especially push the new fibrous dry battery just brought out by the A. B. C. Company, which he believes to be the best battery on the market.

The Washburn & Moen Manufacturing Company, of Worcester, Mass., are to have in their immense wire factory which they are building in Chicago, one room which will contain two lines of the Evans friction cone pulleys, of 75 horse-power each. Each line will contain 12 sets of six horse-power cones, with the driving cones coupled together, making two continuous lines of 75 horse-power each. Each set of cone pulleys gives a variation of from one to nine. The speed can be changed or any cone can be stopped while the main line is running.

The Central Electric Company, Chicago, have received the following,

WATERLOO ELECTRIC COMPANY.
WATERLOO, IOWA, April 27, 1891.
CENTRAL ELECTRIC CO., Chicago.

Dear Sirs: We are just in receipt of your new catalogue of electrical supplies. Please accept our thanks for same.

It is, without doubt, the finest and fullest catalogue sent out by any firm in the United States, if not in the whole world.

Hoping to be able to get even with you for kindnesses in the past, we are,

Very truly yours,
WATERLOO ELECTRIC CO.

Wire and Cable Men Meet in Philadelphia.

The manufacturers of insulated wires and cables met at the Lafayette Hotel, Philadelphia, last week. Mr. E. F. Phillips, of Providence, R. I., is president of the association, and Mr. Thomas L. Scovill, of New York, secretary. Among others present were Chas. Hamilton and H. D. Stanley, of Bridgeport, Conn.; and Alfred F. Moore, of Philadelphia. Mr. Moore gave a very enjoyable planked shad dinner to the visitors.

WANTED.—A young man of good address, to look after sales of insulated wire. Address, with reference, **"C. P."**
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NEW YORK.

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Engine Lathes, 10 in. x 4 ft.; 11 in. x 5 ft.; 12 in. x 6 ft.; 14 in. x 6 ft.; 16 in. x 6 ft.; 18 in. x 6 ft.; 20 in. x 8 ft., with tapes attachment; 22 in. x 12 ft. and 14 ft.; 24 in. and 26 in. x 16 ft.; 30 in. x 10 ft. and 18 ft.; 36 in. and 38 in. x 20 ft.; 42 in. x 12 ft.; 56 in. x 18 ft.; 72 in. x 20 ft.; 108 in. x 22 ft. Fox Lathes; 13 in. x 5 ft.; 14 in. x 5 ft.; 15 in. x 6 ft.; 18 in. x 6 ft. Turret Lathes; 12 in. x 5 ft.; 14 in. x 5 ft.; 13 in. and 16 in. x 6 ft.; 18 in. x 6 ft.; 36 in. x 8 ft.
Planers, 16 in. x 16 in. x 3 ft.; 20 in. x 20 in. x 4 ft.; 24 in. x 24 in. x 6 ft.; 30 in. x 30 in. x 6 ft.; 36 in. x 36 in. x 10 ft.; 42 in. x 42 in. x 12 ft.; 72 in. x 60 in. x 15 ft.; 72 in. x 60 in. x 20 ft.
Friction Shapers, 15 in., 16 in., 20 in., 22 in., 32 in.
Crank Shapers, 6 in., 8 in., 10 in., 12 in., 15 in., 16 in., 20 in., 24 in., 28 in.
Screw Machines, Nos. 1, 2, 3, 4, with or without Wire Feed.
Screw Machines, Nos. 5, 6, 7, 8, Power Feed.
Presses, Nos. 51, 52, 53, Ferracute, Nos. 1, 2, 3, Stiles & Parker.
20 Lincoln Pattern Millers, No. 2.
Hand Millers, Nos. 1 and 2. 3 Cam Cutters.
Bolt Cutters, ¼ in. to 1 in., ¼ in. to 2 in.
2 Profiling Machines. 1 36 in. and 48 in. Gear Cutter.
1 New Horizontal Boring Machine. Newark Machine Tool Co.
Send for May List of New and Second-Hand Machinery.
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327 BROADWAY, N. Y.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON APRIL 28, 1891.

451,101 Electric arc lamp; Charles G. Young, New York.

451,108 Adjustable rest for holding electric lamps suspended; Cyrus A. Danals and William O. Perry, Zanesville, O.

451,121 Electro-mechanical gong striking machine; Thomas F. Gaynor, Louisville, Ky., assignor to the Gaynor Electric Co., same place.

451,125 Electric meter; Frank K. Irving, New York.

451,142 Electric battery; Jean T. Van Gestel, New York, N. Y., assignor to the Crosby Electric Co., same place.

451,143 Telephone call box; Frank Villiers Stead and Elwara R. Hedgman, London, England, assignors to Knight Bros., trustees, New York, N. Y.

451,149 Hanger for electric lamps; Peter S. Bates, York, Pa., assignor to W. F. Bay Stewart, same place.

451,154 Electric railway; Rudolph M. Hunter, Philadelphia, Pa., assignor, by mesne assignments, to the Thomson-Houston Electric Co., Boston, Mass.

451,155 Electrically propelled car; Rudolph M. Hunter, Philadelphia, Pa.

451,157 Electric signal for railways; Uriah S. Jackson, Ossipee, N. H., assignor of one-half to Harry F. Cady, Lowell, Mass.

451,177 Brush holders for dynamos; William Le R. Emmet, East Rockaway, N. Y.

451,189 Electric arc lamp; John H. R. Ward, New York, N. Y., assignor to the Universal Arc Lamp Co., same place.

451,190 Electric switch; Le Roy S. White, Waterbury, Conn., assignor to the Electrical Appliance Mfg. Co., same place.

451,202 Suspending device for electric lamps; David P. Thomson, Lynn, Mass.

451,212 Starting device for electric motors; Edward P. Sharp, Boston, Mass.

451,226 Electric indicator; John L. Ricketts, Philadelphia, Pa.

451,239 System for electrically supplying hot water for consumption and heating purposes.

451,240 Method of and apparatus for electrically supplying hot water for consumption and heating purposes; Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place.

451,242 Armature for electric motors and generators; Perrin Grant, Baltimore Md.

451,250 Electric arc lamp; Addison G. Waterhouse, Hartford, Conn.

451,267 Electric switch; Horace T. Clark, Bridgeport, Conn.

451,290 Insulating swing joint; Henry P. Drew, New York, N. Y.

451,300 Electric arc lamp; Rupert Schefbauer, Patterson, N. J., assignor to the Universal Arc Lamp Co., New York, N. Y.

451,312 Regulator for dynamo-electric machines; Frederich Lischendorfer, Brooklyn, N. Y.

451,320 Electric motor; Rudolph Eickemeyer, Yonkers, N. Y.

451,326 Tension and cut-out device for electric railways; Byron Jennings, San Jose, assignor of one-half to James Brusie, Oakland, Cal.

451,345 Method of electric welding; Elihu Thomson, Swampscott, Mass., assignor to the Thomson Electric Welding Co., of Maine.

451,364 Electric connection; Horatio J. Brewer, New York, N. Y.

451,369 Magnetic ore separator; John P. Conkling, New York, assignor to Gurdon Conkling, Glens Falls, N. Y.

451,370 Magnetic ore separator; John P. Conkling, Glens Falls, N. Y., assignor to Gurdon Conkling, same place.

451,377 Safety connection for electric conductors; Robert H. Gould, Berlin, Germany.

451,379 Insulator; Robert D. Hamis, Corning, N. Y., assignor of two-thirds to Alanson B. Houghton and Arthur A. Houghton, both same place.

451,397 Electric switch; Henry A. Chase, Stoneham, assignor of one-half to George W. Gregory, Boston, Mass.

451,402 Electric railway; Rudolph M. Hunter, Philadelphia, Pa., assignor to the Thomson-Houston Electric Co., of Connecticut.

451,407 Method of making electrodes for secondary batteries; Henry H. Lloyd, Camden, assignor to the Electric Storage Battery Co., Gloucester City, N. J.

TO THE TRADE.
After May 1st, MR. JOHN L. MOORE will no longer represent this company.
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